PAINT and VARNISH Production

THE TECHNICAL MAGAZINE FOR MANUFACTURERS OF PAINT, VARNISH, LACQUER AND OTHER SYNTHETIC FINISHES

NVENTION

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ISSUE

GRAM 86

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OCTOBER
1957

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BOOTH 217

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Brief History of Urea and Melamine Resins
Page 3

Physical Constants of RCI Beckamine and Super-Beckamine Resins
Page 5

Special Properties and End Uses
Page 8

Characteristics Comparison RCI Amine Resins
Page 13

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VOL. 47 OCTOBER, 1957 NO. 11

NEXT ISSUE

An informative article on Isophthalic Alkyds will be presented in the November issue. The author discusses the use of isophthalic acid in the synthesis of alkyd resins, and the properties this acid imparts to the resin. Data on paints formulated with isophthalic alkyds are also presented.

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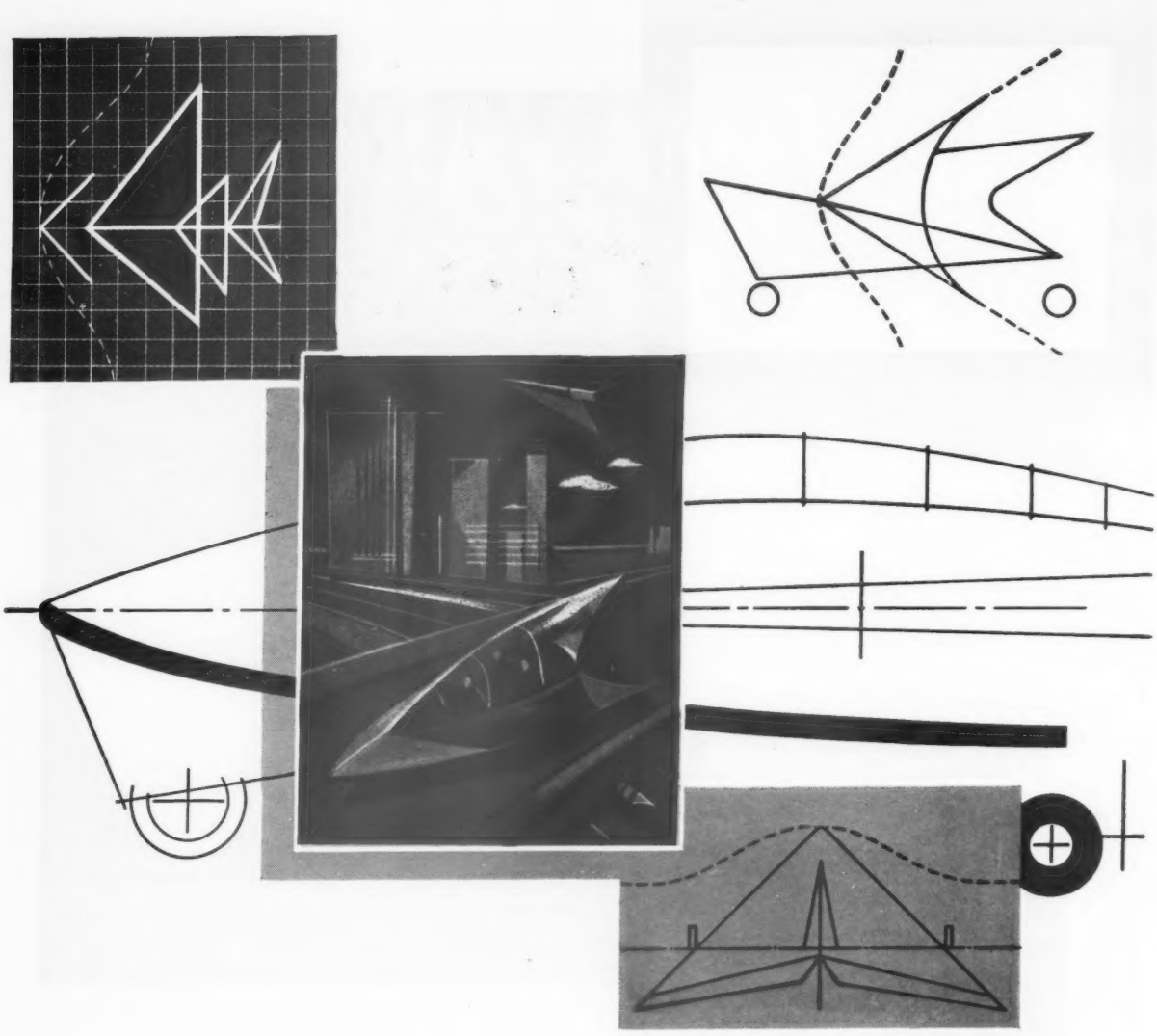
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Editorial Comment

October, 1957

70th Convention

THIS year the National Paint, Varnish and Lacquer Association will hold its 70th Anniversary meeting in Washington, November 4-6.

Apropos to the occasion, the association has arranged an informative and interesting program that will appeal to all managerial levels within the paint industry.

Noted speakers include the Hon. Sinclair Weeks, Sec. of Commerce; the Hon. Wallace F. Bennett, Senator from Utah; and Leo Cherne of the Research Institute of America.

Several panel discussions and forums have also been planned. These include the Putty, Glazing and Caulking Compound Forum, the Roof Coating Manufacturers' Forum, The Advertising and the Sales Promotion Managers' Forum, and The Trade Sales Forum. The Industrial Product Finishes Luncheon and Management Panel will feature a discussion on developing sales leadership.

For those who plan to bring their wives, the Association has scheduled an exceptional series of interesting social events.

To keep abreast of developments within your industry plan to attend the N.P.V.L.A. Convention in Washington early next month.

Wall Coverings Hit Furnishings Show

WE took in the Home Furnishings Show at the Coliseum in New York last month and were amazed to find the great impact that wall coverings are making in the decorating field.

Appealing to the "do-it-yourself" home-owner, exhibitors of such products went all out to show how easy it was to apply the material and, more important, what unique decorative effects can be achieved, ranging from brick to Aztec sculpture.

We looked around the exhibit area to see if anyone was demonstrating the merits of paint in home decoration and finally discovered *only one* who was pushing spatter finish.

Those who attended this show could not help being impressed by wall coverings as a decorative material. It is unfortunate that there were not more exhibitors demonstrating the versatility and advantages of paint products to take some of the wind out of wall coverings.

"Tailor-Made" Polymers

RESULTS of present research studies on high polymers strongly indicate that "custom-tailored" polymers of unusual molecular structure will be synthesized in the not too distant future. Work now being conducted at the College of Forestry, State University of New York (Syracuse) under Professor Michael Szwarc have resulted in new polymerization techniques which make it possible to stop the polymerization reaction at will; control the molecular weight with extreme precision; reduce polymerization side reactions; and synthesize unusual, custombuilt block copolymers.

In the synthesis process, Szwarc is able to keep the polymers alive during the propogation, feed in more of the same monomer (or a different one) and terminate the reactions when the desired polymer is formed. Working with styrene, isoprene and butadiene, Szwarc has been successful in producing polymers with unusual physical and chemical properties.

The significance of Szwarc's work is quite obvious. For the coatings industry it could very well be the basis for the development of new film formers having special properties that could meet any application.



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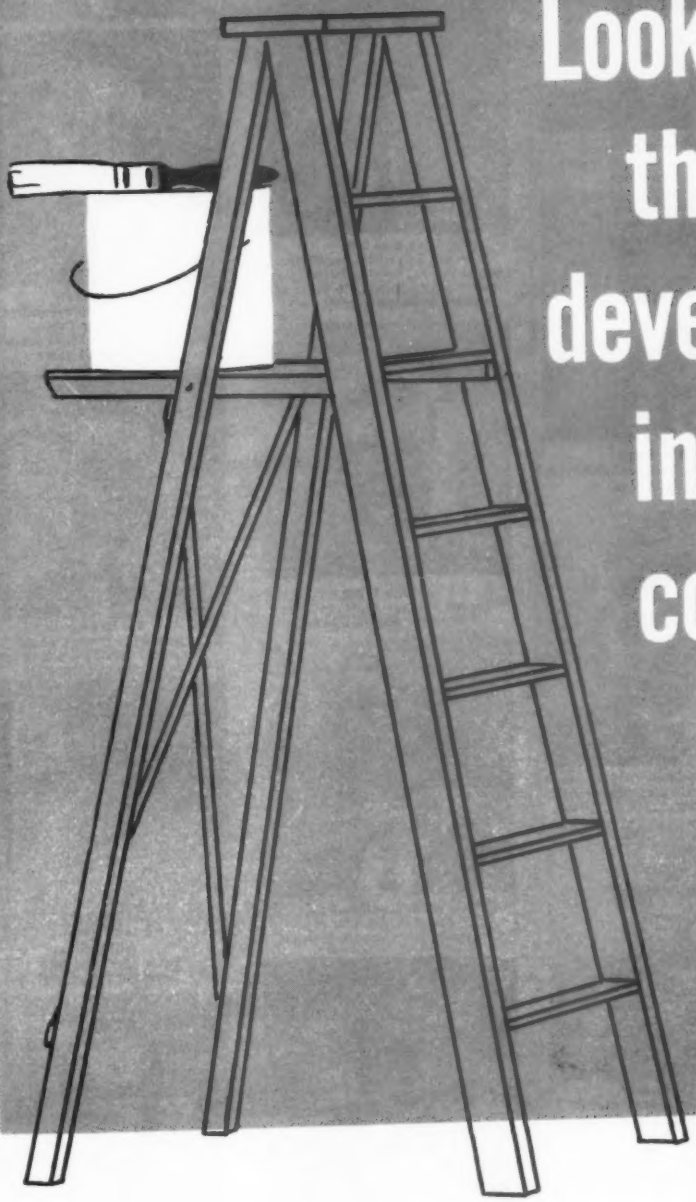
We're helping you sell latex paint to this lively market by pointing out its success in each field. We're underscoring the reasons for its success. And in each case, we outline again the unique qualities of latex paint that make it a natural choice for long-lasting beauty and easy upkeep.

Are you getting your share of these sales? Cash in on the growing demand for latex paint. Put your brand name on the paint that is the big favorite of professionals and do-it-yourselfers alike. See your Dow man about latex. Or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Dept. PL 1869M-1

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Look into the new developments in coatings

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Vern Larson
Western Zone Manager from our Chicago Office.



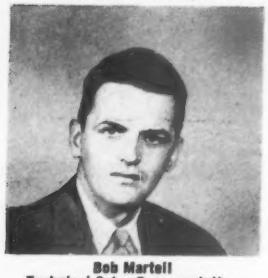
John Ingram
Technical Sales Representative from our Cleveland Office.



Cliff Schwahn
Latex Sales Specialist now assigned to our New York Office



Jim Fryman
Technical Sales Representative for the New York Area.



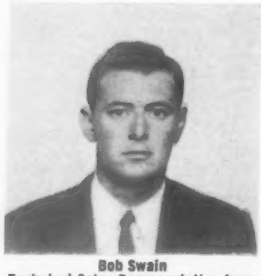
Bob Martell
Technical Sales Representative from our Hartford Office.



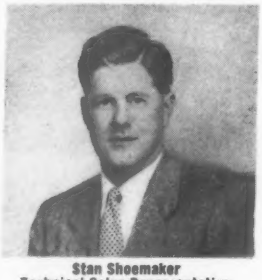
Bob Norum
Eastern Zone Manager from our Clifton Office.



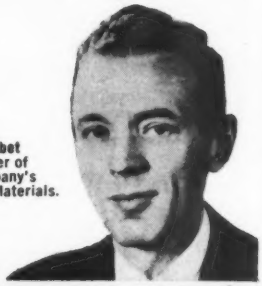
Chuck Droman
Technical Sales Representative from our Clifton Office.



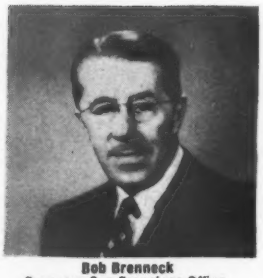
Bob Swain
Technical Sales Representative from our new Washington, D. C., Office.



Stan Shoemaker
Technical Sales Representative from our Philadelphia Office.



Roger Calsibet
Sales Manager of Bakelite Company's Surface Coating Materials.



Bob Brenneck
From our San Francisco Office. Bob is Dean of our Technical Sales Representatives with 35 years of service to Bakelite customers.



George Young
Technical Sales Representative from our Boston Office.



Ken McCullough
Assistant Director of Coatings Development Division.



Stan Richardson
Group Leader in charge of Non-Solvent Coatings Development.



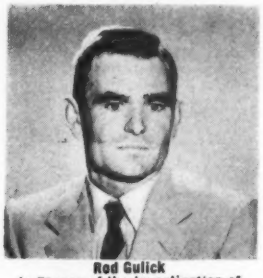
Bob Given
Technical Sales Representative from our Clifton Office. Bob has served Bakelite customers for over 31 years.



Bill McKnight
Heads the newly created Technical Service Group in our Development Laboratory.



Will Sullivan
Latex Specialist from our Development Laboratory.



Rod Gulick
In Charge of the Investigation of Solvent Coatings in our Development Laboratory

...to take you behind the scenes on these new developments:

Learn how you can profit from developments in coating materials and systems mentioned below as well as improvements in existing coating materials and techniques.

INVESTIGATE...

WC-130 POLYVINYL ACETATE LATEX-BASED PAINTS

There's a wealth of new information at the Bakelite Company exhibit on this important group of paints. Interest is higher than ever . . . so get the latest information on:

Color Uniformity and Sheen Uniformity. Check these characteristics under the most exacting conditions. At the Bakelite Company exhibit you'll be able to make critical examination of the sheen and color uniformity of BAKELITE WC-130 Latex on large-size panels.

Exterior Exposure Results. See how these coatings have performed under trying conditions of exposure in many different climatic conditions. Now for the first time, see results of tests covering periods of up to three years! And there is important news on new exterior masonry finishes.

Laboratory-Tested Demonstration of Latex Properties. Photographs and other descriptive material will show why BAKELITE Brand Latex WC-130 rates superior. See the results of borate stability tests that demonstrate ability to easily and satisfactorily cover joints in wall board.

LEARN ABOUT THESE...

INDUSTRIAL PRIMERS AND FINISHES

The constant search for better protection of equipment and plants demands longer lasting coatings that can be applied with less work. See the latest developments:

New Aluminum Paint Techniques. See the new latex ready-mixed aluminum paint for interiors. Also, see the tinted aluminum (ideal for decorating reflective surfaces, color coding pipes) for use on such interior surfaces as metal, drywall, plywood, pipe insulation.

Exposure Tests on Cold-Mixed Phenolic Aluminum Paints. You will see good covering still intact after long exposure to the elements. These maintenance coatings are used on water towers and other metal structures. And these formulations retain leafing over long storage periods.

Results of Tests on Phenolic-Vinyl Primers. Here you will be able to see results of exposure for thousands of hours of a solution coating and a dispersion coating over this primer. And you will be able to see plastisol adhesion under a rugged bend test.

HERE ARE 2 PREVIEWS OF PROJECTS STILL IN DEVELOPMENT STAGES

High Gloss Latex Enamel. See the progress we're making on a new paint with high gloss and based on an experimental latex. Yet, it still offers all the desirable characteristics of conventional latex paints . . . easy cleanup, little odor, easy application.

New System with Phenolic Primer and Vinyl Topcoat. This promises all the advantages of vinyl coatings over rusty surfaces with a minimum of preparation. Ordinarily, the surface had to be sand-blasted and carefully prepared. Actual in-use tests are under way.

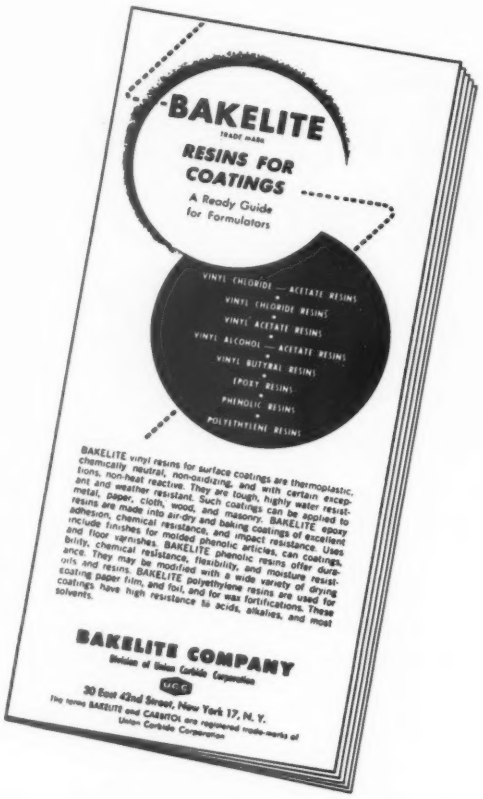
VISIT BAKELITE BOOTH NO. 201-203 AT THE 1957 PAINT INDUSTRIES SHOW

THIS YEAR, AS FOR MANY YEARS...

The news is at the BAKELITE Company Exhibit

Constant research and development at Bakelite Company Laboratories, backed by the resources of Union Carbide Corporation, continually makes news at Paint Industries Show.

Shown in this insert are only a few of the many interesting things to see and learn about at the Bakelite Exhibit. A complete new portfolio of literature, technical data and formulations will also be available. We hope to see you at the Show. BUT, if you cannot attend, write for your copy of "RESINS FOR COATINGS"... a Ready Guide for Formulators.



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Aroplaz finishes designed for "the Ford in your future" are on test under all climatic conditions at exposure panel stations today. How well they measure up to Ford's exacting specifications after exposure tests will decide whether or not finishes containing Aroplaz continue to be used. ADM is happy to stand or fall on this basis . . . the same basis which earned Aroplaz the right to help protect and beautify Ford cars for the past three years.

Aroplaz has withstood the toughest exposure tests possible. If you think it can satisfy some of your needs, too, write today to *Archer-Daniels-Midland*, 729 Investors Bldg., Minneapolis, Minn.

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UFORMITE MX-61 exhibits outstanding compatibility with a wide range of alkyd resins and other film-forming materials. And it has a high mineral thinner tolerance.

In addition to UFORMITE MX-61 there are thirteen other UFORMITE resins from which you may choose to meet your specific needs. Write for information or technical assistance.

UFORMITE *is a trade-mark, Reg. U.S. Pat. Off. and in principal foreign countries*

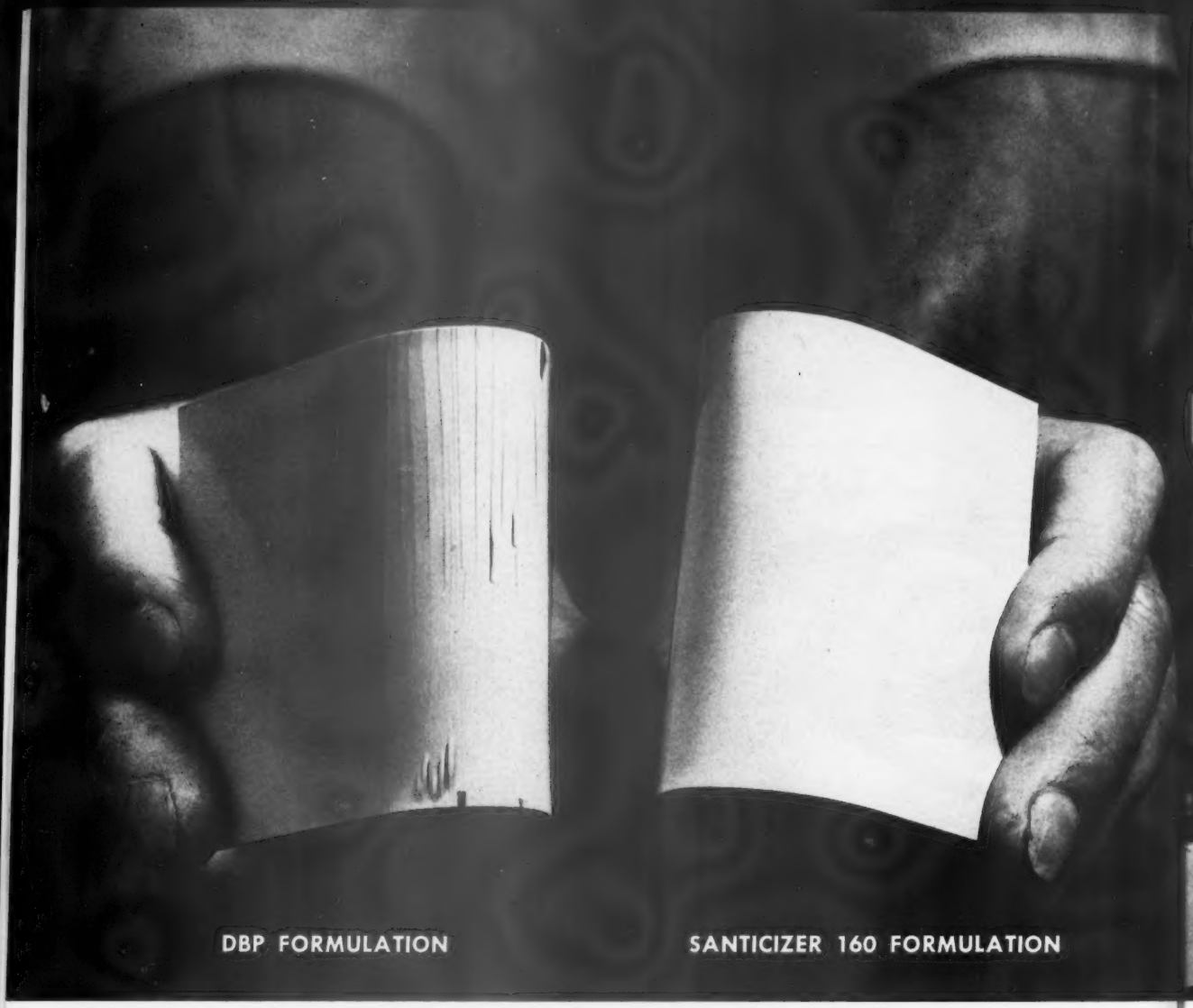
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Here are three important examples showing how Santicizer 160 improves flexibility retention while costing less to use than other plasticizers. In nitrocellulose lacquers, Santicizer 160 imparts lasting flexibility, toughness and abrasion resistance. Its strong solvating power helps build up solids content to give thicker films and higher gloss. It actually increases resistance to water spotting, and in normal concentrations reduces cold checking without inducing tackiness. Yet, Santicizer 160 is less volatile, more permanent than dibutyl phthalate . . . and costs less on both a per-pound basis and a pound-volume basis.

PVAc sealers and masonry finishes with Santicizer 160 retain their flexibility better than with DBP, even at lower concentrations, according to Federal Specification TTP-29. Reasons are that Santicizer 160 is less volatile and is more resistant to water extraction. It promotes adhesion, boosts moisture resistance . . . improves performance at lower cost.

New acrylic metal lacquers are also being plasticized and extended with Santicizer 160 for these same performance benefits plus these additional reasons: It does not retard solvent release or reduce the gloss inherent



PVAc WATER-BASED MASONRY PAINTS with Santicizer 160 are less apt to become brittle and fail due to loss of plasticizer by volatilization and water extraction.



NEW ACRYLIC METAL FINISHES also gain performance benefits . . . acrylic lacquers on the market contain more Santicizer 160 than all other plasticizers combined.

SANTICIZER 160, versatile•universal plasticizer

in acrylic lacquers. And its low volatility makes it particularly desirable for hot spray applications.

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with

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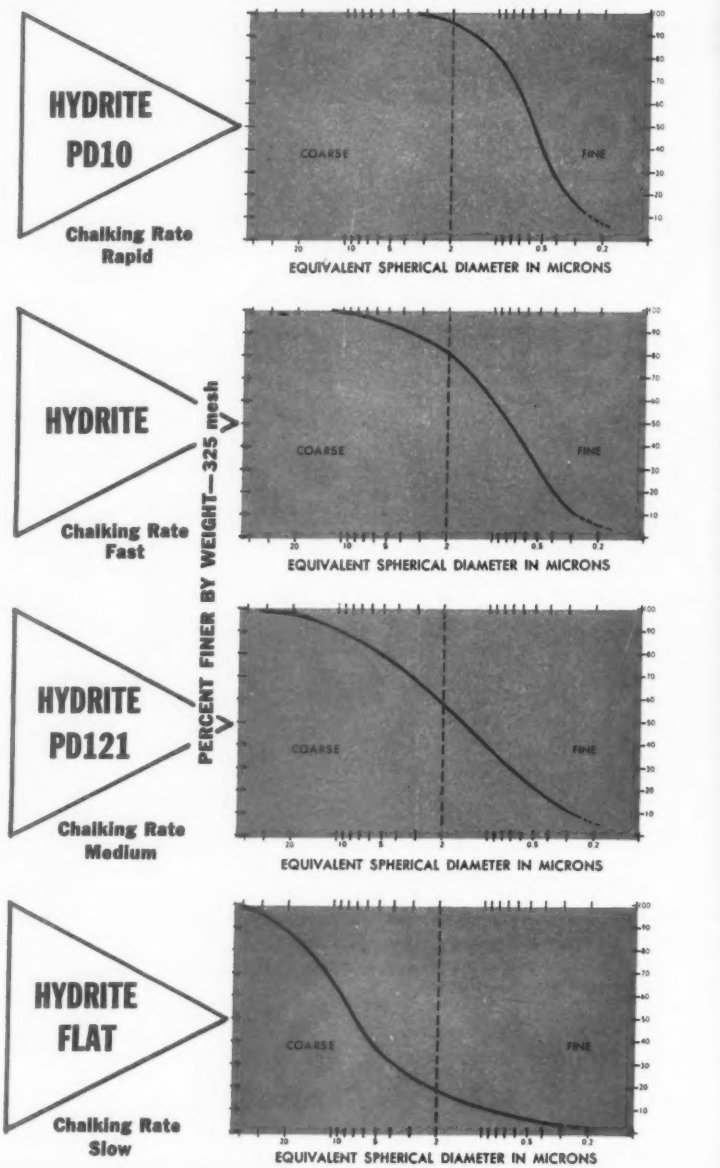
Recently concluded exposure tests on exterior emulsion paints have shown that the rate of chalking varies directly with the particle size distribution of the extender pigment. All extenders in common use today were tested, including Georgia Kaolin's Hydrite Kaolinites.

These Kaolinites — because of Georgia Kaolin's super centrifuging — offered the widest range of controlled particle size distribution. The result is that exterior emulsion paints formulated with Georgia Kaolin's Hydrite Kaolinites have the broadest span of chalking rates.

PARTICLE SIZE DISTRIBUTION

The particle size distribution curves of the GK extenders tested are shown at the right. Particles are in two distinct shapes —plates and stacks. The form changes from one to the other at about 2 microns. Our tests show that chalking is more rapid where plates predominate, and slower where stacks prevail.

PARTICLE SIZE DISTRIBUTION



Consult GK technical service for further information regarding chalking rates and other paint properties affected by pigment extenders.

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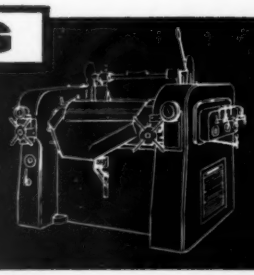
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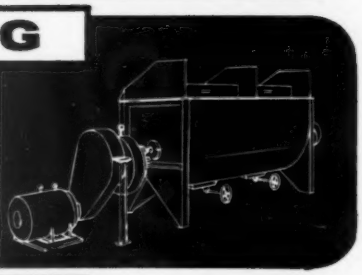
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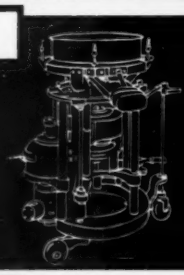
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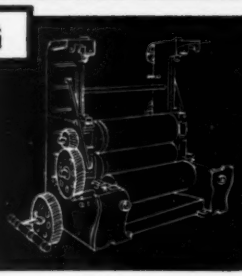
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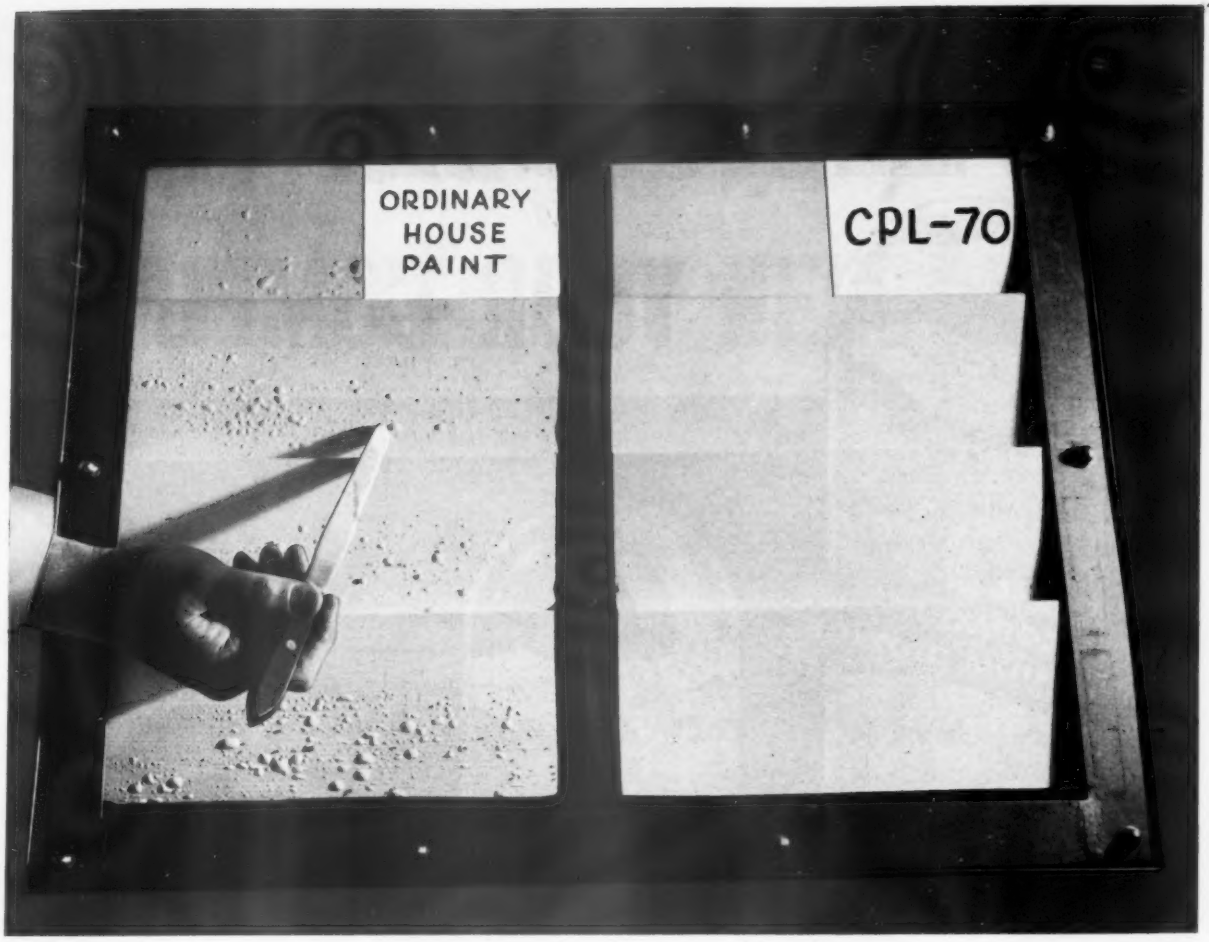
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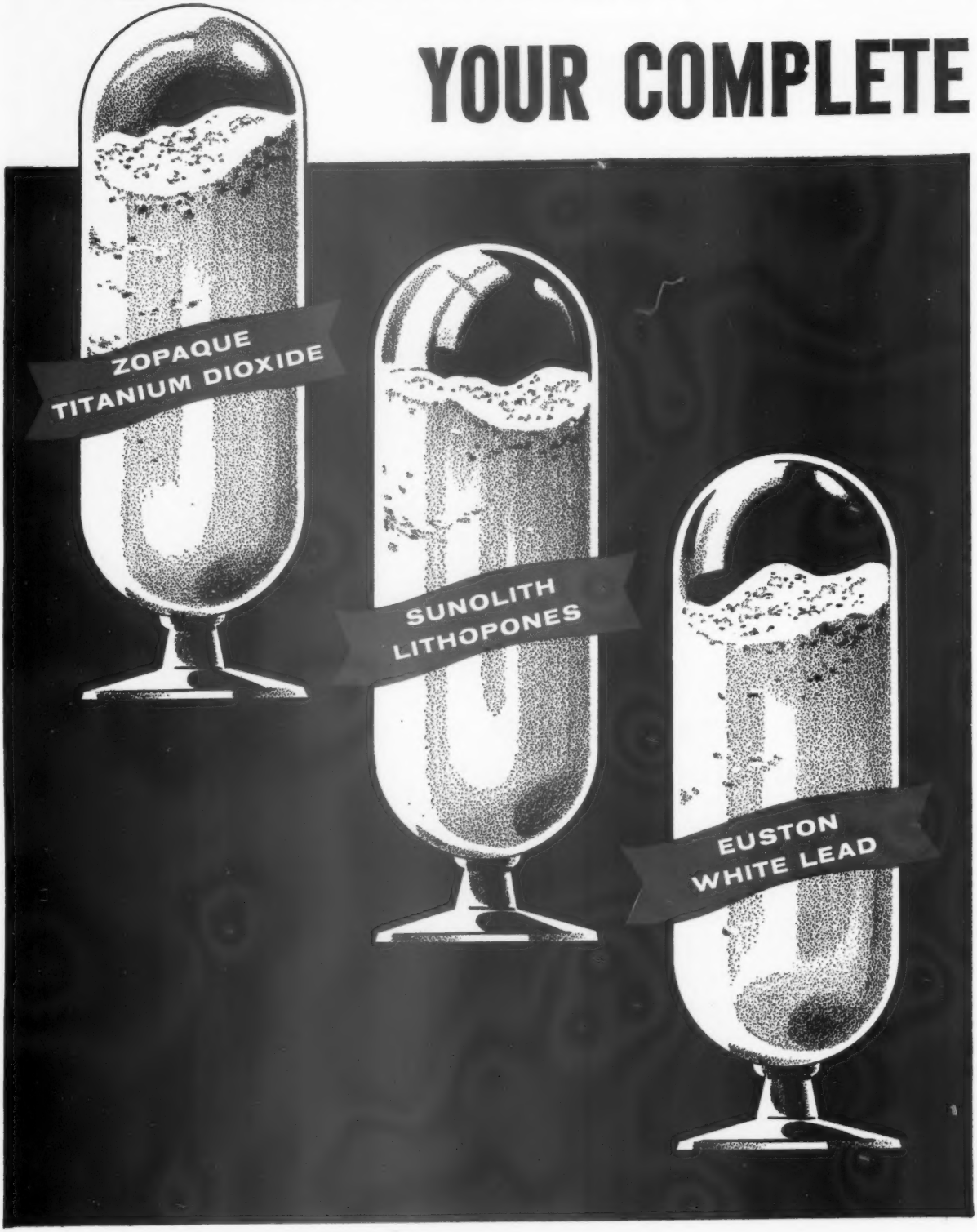
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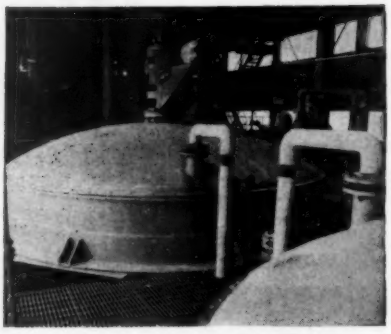
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Ventilators were painted in April, 1953 and were in the condition shown in June, 1956.

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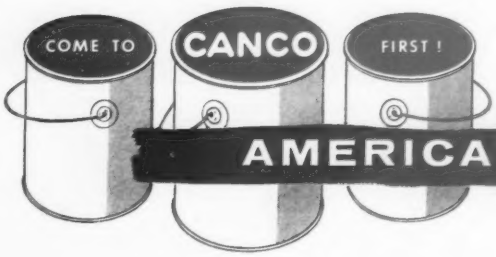
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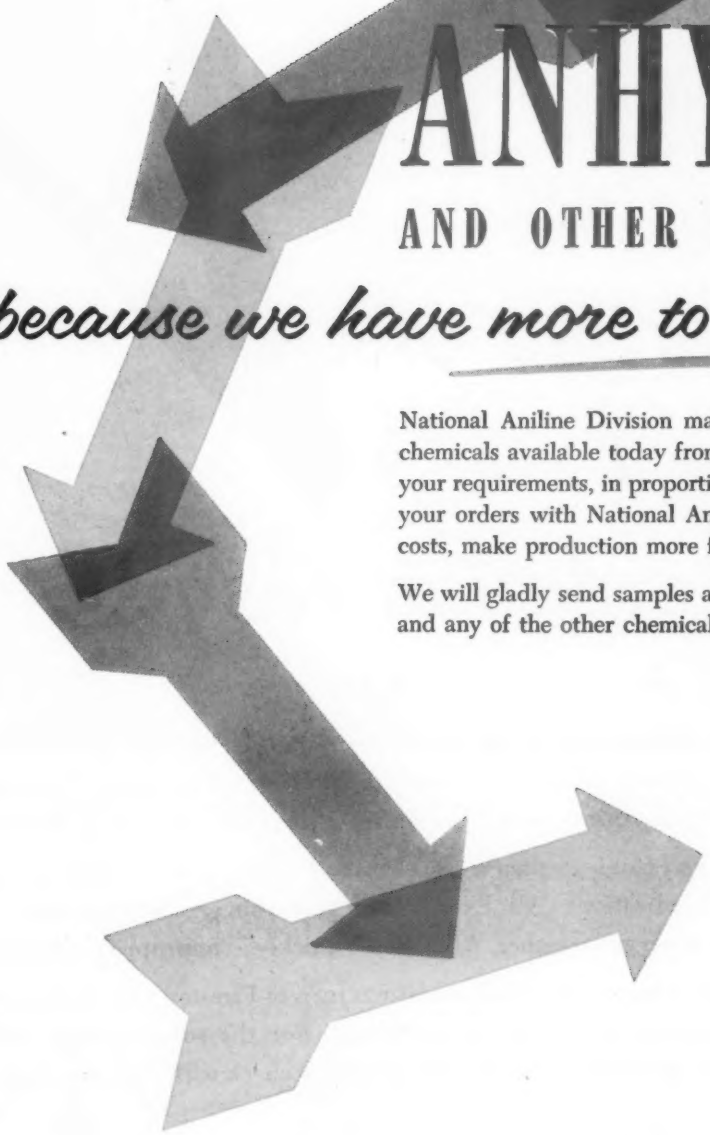
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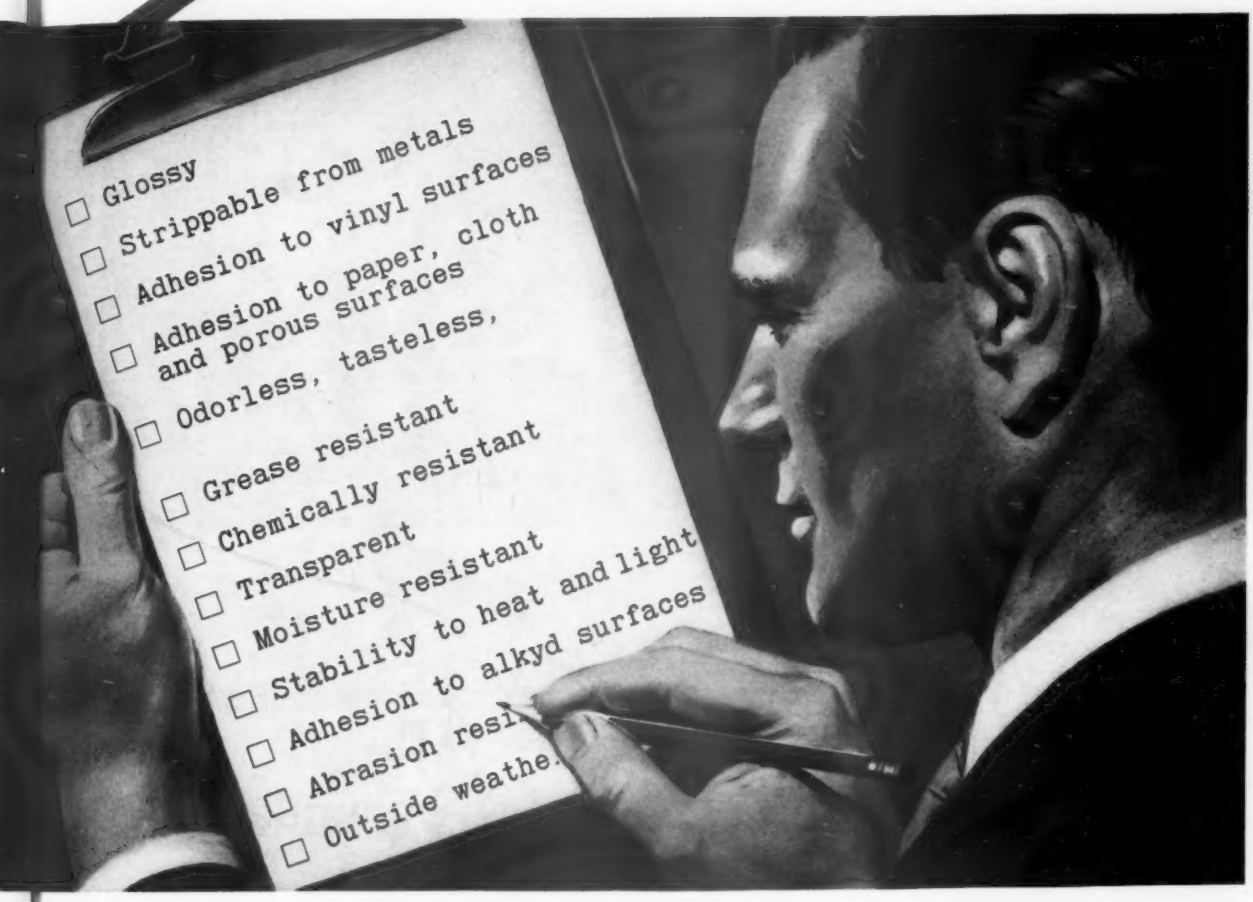
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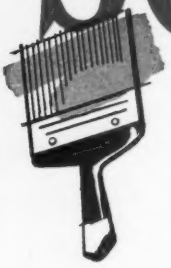
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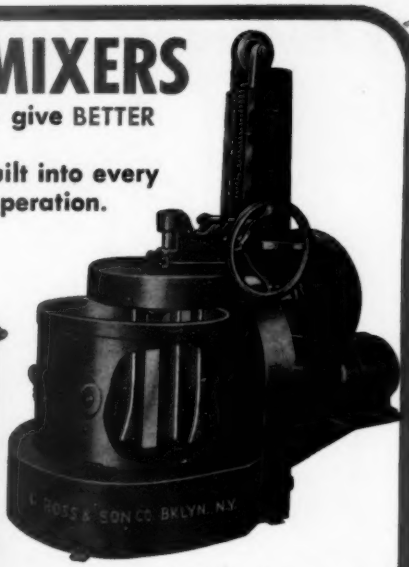
The RUGGED HEAVY DUTY CONSTRUCTION built into every Ross machine assures dependable trouble-free operation.



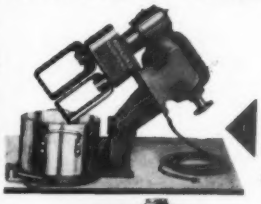
#130 CDM—165 gal. Double Motion Change Can Mixer. **60, 80, 130 and 165 gal. sizes. Stirrer action provides 12 intense compressive and shearing actions during each revolution of stirrers around can.**



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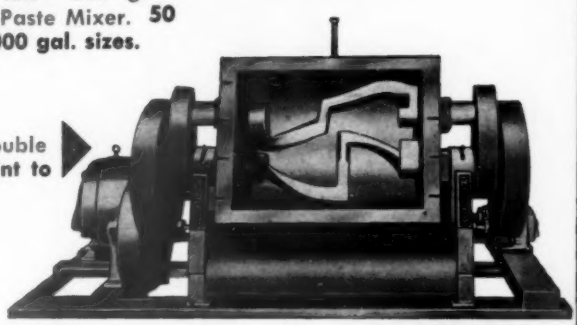


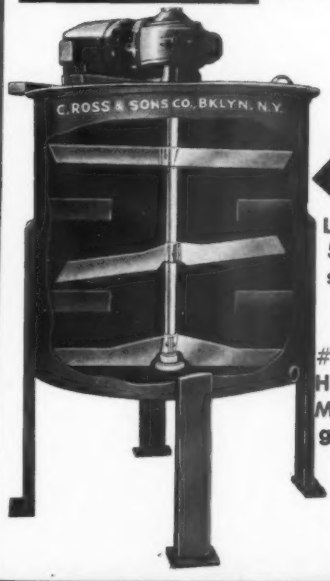
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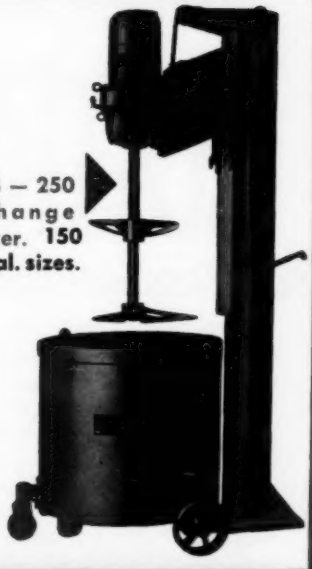


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All opinions expressed in signed articles are strictly those of the authors, and do not necessarily represent editorial endorsement by this publication.

FOREWORD

In the wake of rising labor and material costs without corresponding increases in productivity, many firms have taken aggressive steps to beat the "profit squeeze."

The accelerating use of instrumentation resulting in increased production and efficiency has attracted considerable attention as one of the most effective means of lowering operating costs in this era of inflation.

Instrumentation has had its greatest impact on the chemical industry. This is evidenced by the fact that the average chemical firm of today allocates as much as 15-20% of new plant cost for instrumentation. However, in the paint industry instrumentation has been applied on a limited scale—although in the manufacture of varnishes and alkyd vehicles it has enjoyed a fair measure of success in boosting production and maintaining product uniformity.

Undoubtedly many would question the feasibility of utilizing instrumentation in paint manufacture which is considered a simple process—mainly a batch operation. As Slater points out (page 41) it is the simple manufacturing process, the operation, where major problems are handling materials and maintaining product quality rather than controlling difficult chemical reactions, that can benefit materially by the use of instrumentation.

One does not have to look very far to find what applied instrumentation is accomplishing in industries which involve rather simple operations.

For example, in the candy-making industry, where some phases of the manufacturing cycle are in some respects similar to that of paint processing, automatic controls have resulted in lower manufacturing costs, minimum waste, and improved quality. Instruments to indicate, record and control temperature, pressure flow, viscosity and other variables have converted a manual batch process to a straight-line automatic operation. Production time was reduced from 16 hours to 35 minutes, production space by two-thirds, and man-hours per unit by more than half.

The special features which follow are designed to acquaint you with the various aspects of instrumentation and how it may be utilized in paint manufacture. Specific controlling devices which have direct application as well as those which may have future application are discussed in detail.

It is our sincere hope that in this attempt we have aroused your interest to delve more deeply into this important subject of instrumentation and discover how this powerful engineering tool may be used to advantage in your laboratories and plants.

ANTHONY ERRICO, *Editor*

INSTRUMENTATION COMES OF AGE

A tool for converting the theoretical to the practical is now universally recognized after 10 years of exciting progress

By Lloyd Slater*

IN the fulfillment of ten years of exciting progress, instrumentation now has a "new look": it is recognized as a unique and powerful engineering tool which can not only be used to "automate" paint manufacture, but which may be the key to solving some of the theoretical break-throughs which are inherent in the processes of this industry.

Before exploring this thesis let's first consider what is today implied when we use the word "instrumentation". Prior to World War II the main implication of instrumentation was its function of measurement. Industrial instruments and instrument systems were devised to register the variables influencing product manufacture. Feedback signals and automatic control were an adjunct to this primary function—albeit quite a successful adjunct in the large continuous-flow chemical processes. But the major technical emphasis at that time was on the science of developing an analog scale signal of such values as temperature, pressure, flow, level, etc.

World War II, with its demand for self-regulating systems in weapons, nurtured two additional basic functions in instrumentation: the functions of *computation* and *control.* A new disciplined approach based on applied mathematics made possible the design of instrumentation systems on a *predictable* basis. The functions of logical computation and self-regulation (control) became as important as the primary measurement itself.

In the post-war flurry of converting military to industrial techniques it took several years before the new impact of instrumentation was obvious. But recently two important signs indicate that instrumentation has "come of age" for the industrial user: 1) the prolific appearance of new and needed forms of hardware to exploit this technology (e.g. on-stream analyzers, analog computers, servo-actuators); 2) the steady increase in properly trained specialists in this field.

Today, with shining examples of its recent accomplishments as a guide, this new concept of instrumentation is shaping this outlook in alert industrial managers: *that it is a distinctly new engineering-science, practised by trained specialists, with potent possibilities for perfecting the automaticity of existing industrial processes and perhaps for catalyzing complete innovations in the methods of manufacture.*

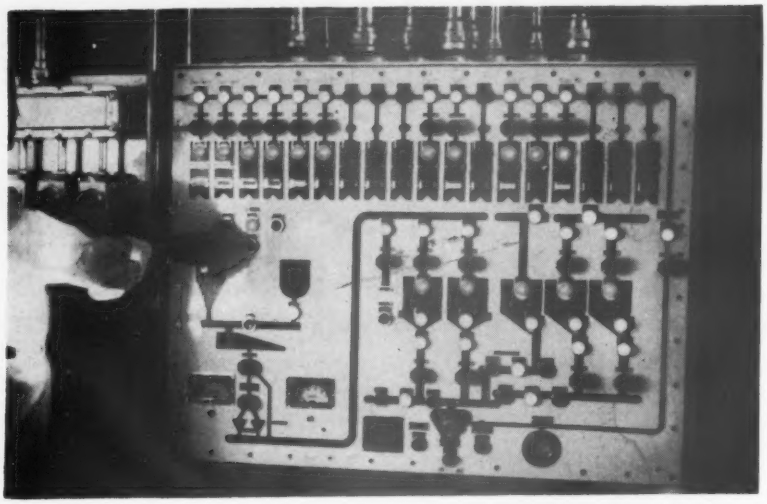
For Paint Manufacture?

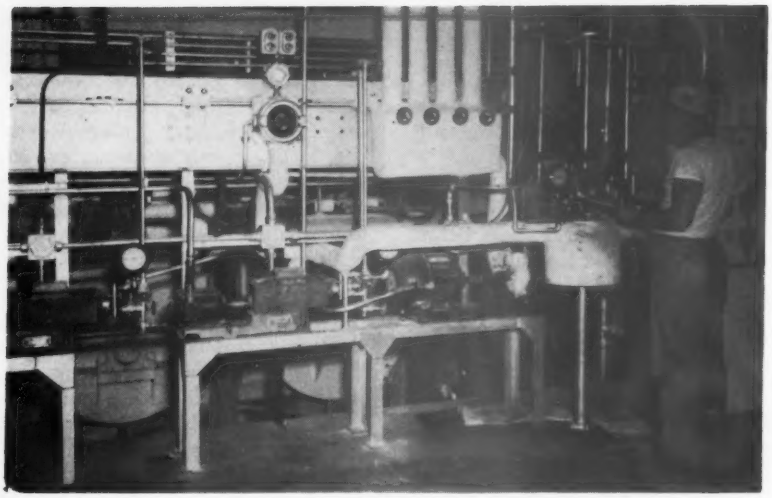
Some pragmatic individuals would contest the utility of this new engineering-science of instrumentation in paint manufacture. "Computers, on-stream analyzers and servomechanisms are fine for large and complex operations such as "cat" cracking or polymerization," they might say, "but making paint is a relatively simple process, mainly batch, and hardly worth the longhair ministrations of instrument specialists. What we need is better materials handling and quality control—not complex electronics."

Oddly enough, experience shows that it is the relatively simple manufacturing scheme—the operation where major problems *are* handling materials and maintaining product quality rather than controlling difficult chemical reactions—that benefits almost dramatically by a studious application of the techniques of instrumentation. Paint manufacture could be an outstanding example of this inverse rule.

For the fact is that both materials handling and quality control face a developmental barrier until exposed to instrumentation. When dynamic measurements and control techniques are used to precisely move the bulks over scale and conveyor and to mete the fluids through pipes and vessels—then and only then will effortless and consistent batching take place. Similarly, when these techniques are systematically applied in the in-plant, in-process measurement and control of both raw and finished product qualities—then and only then will quality control move into a phase of positive "specification building" the prod-

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An example of advanced mechanization through instrumentation is provided by prepared bakery-mix plant in Springfield, Ill. Graphic panel (above) controls solids flow through process. Liquid ingredients of mixture are metered in by positive displacement pumps and flow meters (below). Mixers are in background.

uct rather than inspection and control "after the fact".

Most rewarding, however, in the application of instrumentation to these two basic problems of batch manufacture, is the fact that materials handling and quality control actually merge into a unified *system* in the process. And that the elaboration of this *systems concept* can often lead to completely new and highly desirable schemes of semi-continuous and continuous manufacture.

The Method

To help prove our thesis, let us consider how an instrumentation engineer might apply this *systems* approach in a typical paint manufacturing plant (but please remember that the author has no experience in the paint field-hence his examples and terminology are *really* hypothetical).

First off, instead of charging right in and doctoring up the existing process with gadgets, the instrument engineer will initially study *what* is being made: he will analyze the final product qualities and their measureability.

What will our engineer find? To name a few, he will probably discover that the important product qualities (see Table I) can be measured, and he may roughly identify the variables in the process which influence these product qualities.

Having identified the important consumer qualities, our engineer may next elect to determine those measurements which could be made *in the process stream* and thus perhaps permit a manual feedback signal or ultimate automatic adjustment of the process itself. He may find, for example, that a dynamic (continuous and rapid enough for corrective action)measurement of brushability or consistency of the paint not only offers a significant index of product quality, but suggests a practical feedback or control of the technique of blending the paint mixture (e.g. an "end point" for mixing time, or a rate-control for adding a pigment into its medium). On the other hand, he may discover that the time lag between grinding of pigments and their ultimate addition to the mix is too long to make feedback control from a gloss measurement effective. He would also, of course, discover (and cope with, we hope) the unique problems of measuring these qualities in flowing paint prior to the packaging operation.

It is when the instrument engineer is faced with the problem of matching significant quality measurements with control of the process that full use of the "new look" in modern instrumentation takes place. At this point the engineer does what is essentially an analytical systems study of the process itself; he analyzed its time constants, its capacity, its lags. If these inherent factors in an existing process deter the instrument engineer in his efforts to "close the loop"—if he discovers that automatic control from product quality is impractical in the present arrangement—why he may capitalize on his lack of tradition and know-how in paint making and come up with a completely new approach in processing (which may actually work!).

For example, in our engineer's efforts to tie a rheological measurement of paint consistency into automatic control of the mixing process he may evolve the concept of a workable continuous mixer, with actual product measurements being made inferentially by agitator load determinations during mixing.

Flow Control

Carrying our hypothetical systems study for an automatically-controlled paint making process a bit farther, it begins to become clear how the instrumentation approach inevitably turns on the problems of materials handling. In his efforts to establish a criteria for process control through quality measurement (the conversion of conventional static quality control into *in-stream quality control*) our engineer has foundered on the inherent uncontrollability of a batch process. In an operation which is mainly bulk delivery and proportioned blending, it has been economic to use large vessels for transfer and mixing of product. The very size of the equipment and the lump-sum aspect of handling ingredients, however, makes precise, continuous measurement downstream from the process meaningless. How can representative product measurements be made when such time lags are involved? And what delicate corrective actions can be taken during process when the ingredients are so voluminous per batch?

The answer, says our engineer, is to reduce the capacity of the process: to make the vessels smaller and move product through at a much faster rate.

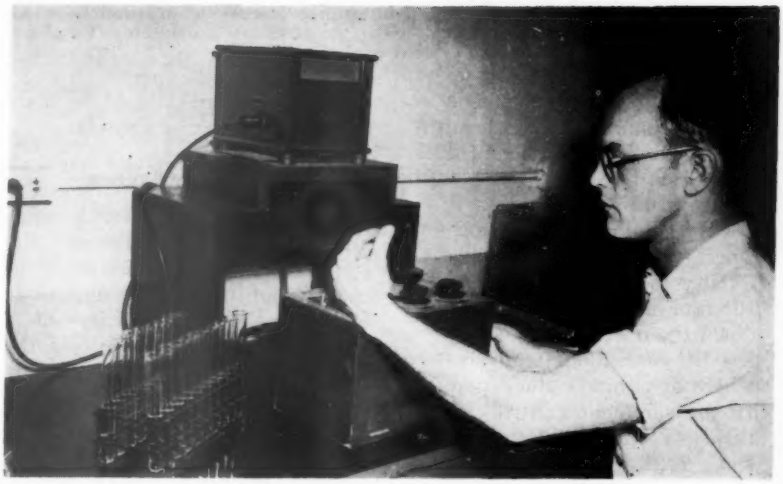
Speeding up a batch process calls for programming—the time-sequenced control of materials into and through the operation. And time-sequenced control of materials usually calls for vast improvements in the established methods of materials handling. The needed conversion, suggests our instrument engineer, is from what essentially is weight and volume control technique to *continuous flow control.*

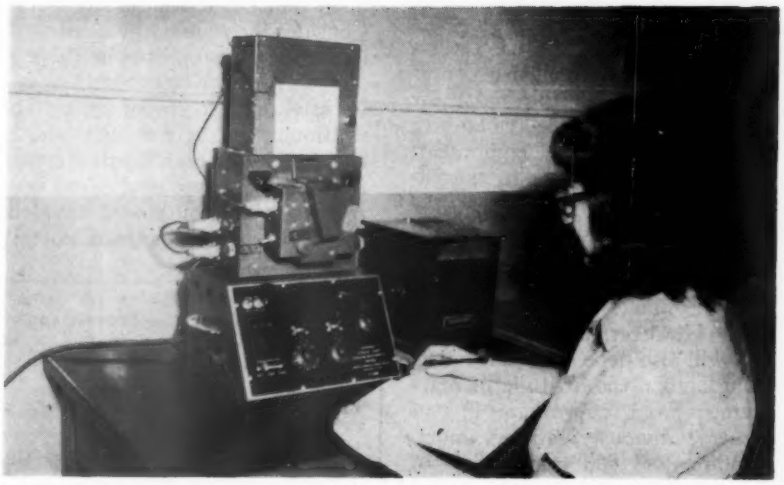
In recent years many new methods for metering both dry and liquid ingredients into a process have appeared (the article by Mr. Lawrence Lowey in this issue reviews most of these developments). Hence our engineer has no problem in selecting appropriate ways to reduce capacity through proportioned feed and time-programming.

The big problem that our engineer faces—the one alluded to in our previous discussion of continuous quality measurement—is

THREE "TOOLS" FOR COLOR MEASUREMENT







Three basic approaches to the in-stream measurement of color are through spectrophotometry (upper photo), bridge-type color comparators (center photo) and automatic tri-stimulus meters (lower photo) which approach human eye values in perceptiveness. Continuous-measuring versions of these three bench units have been applied in industry.

THREE "TOOLS" FOR QUALITY MEASUREMENT







Unit at left uses gamma rays to measure density in sample flow-chamber (Ohmart Corp.); Turbidimeter (center) continuously measures amount of suspended particles (GE); in-stream viscosimeter (Brookfield Lab) is sensitive to within 0.2 per cent (right).

that of tying quality instrumentation into some method of automatic regulation of the process itself. He has two main approaches to this problem:

1 - By "end point" control—where the significant product quality measurement controls the rate of batching and shuts down the operation.

2 - By continuous analysis—where dynamic product quality measurement controls the ratio of ingredients and/or some critical variable in the process.

Which route our engineer selects in our hypothetical plant depends upon many factors (e.g. the investment; the ability to measure product continuously; the need for more productivity; the availability of appropriate control equipment, etc.). The ideal route to the engineer, of course, would be the second one, where the conversion of an existing batch process to a continuous operation is essentially brought about by instrumentation. However, proceeding either way will also depend on a less tangible factor: the attitude of management and co-workers in the plant. Obviously, strong understanding and endorsement of the project is needed from management since time and money is required when a new system is being pioneered. And the lack of active and friendly cooperation from operating personnel could quickly scuttle this in-plant venture.

Equipment and the Experts

We have briefly (and with a fair amount of literary license) described the method which might be used by an instrument engineer to improve the automaticity of a paint making process. Now the question might be asked, are there appropriate existing instrument and and control devices to implement this method? And where would a paint manufacturer find the trained specialist who can put the equipment and the techniques to work? Consider the primary product quality measurements listed in Table I. Are there colorimetric techniques sensitive and foolproof enough to continuously register the subtle changes in color as paint comes from a mixing process? And isn't rheological measurement too delicate and too experimental to rely upon as an industrial plant control?

As O. H. Olson clearly explains in his article later in this issue (see page 76), color is a complex phenomenon and far from simple to measure and control. However, as Mr. Olson also reveals, the "tools" that have been recently developed for continuous measurement of color are varied and capable. Relatively simple abridged spectrophotometers have been successfully applied to primary colored fluids and to some products colored by simple ratios of the primaries. An ingenious instrument engineer can modify and redesign this type of unit to suit almost any production scheme. More sophisticated "comparator" type instruments—those comparing the product against a desired standard color—are successfully detecting color differences in the product stream far beyond the perception of a highly trained human observer.

Product Quality	Process Variable	Possible Instrument Approach
color and shade	pigment chemistry	colorimetry
opacity	fineness of suspension	refractometer or turbidimeter
brushability	blend proportions	rheological instruments
gloss	fineness of grind	glossimeter

Table I.

In the same generic category as color measuring instruments are recently developed instruments for measuring turbidity (opacity) and gloss. For example, a pipe-line type recording turbidimeter was introduced that continuously measures the amount of particles in a suspension with less than 2 percent error. And if refractive index proves the better route to an assay of opacity in paints, a continuous comparator type has appeared which is sensitive to changes of 1 ppm refractive index.

Heretofore the science of Rheology—the study of the deformation and flow of matter-has been a technique of the research laboratory. Paint chemists, for example, have used rheological measurements to determine the effect of work-softening on the flow of product and have probed the importance of yield value on the surfacing qualities of paints. One phase of rehology, however, has progressed to ruggedized production applications: the measurement of viscosity. And as Mr. Stanley LeSota reveals in his article in this issue (see page 60), viscosity feedback control systems have already been devised for some paint handling processes.

While the importance of viscosity control cannot be overemphasized, the author believes that considerable potential also exists for other specialized rehological measurements in paint manufacture. Consider both a desireable and then an undesireable rheological property in paint: the desire for work softening (thixotropy) to prevent running of the product after application, and the unwanted property of yield value (the lack of flow until a certain stress is applied) which may give a stippled or mottled appearance to the finish. Both of these phenomena might possibly be continuously identified — and controlled — by proper instrumentation. Once again, an ingenious instrument designer could contribute much in this area.

Aside from the many advances in product quality measurements, the hardware for making sense from these measurements and effecting corrective action on a process is myriad. One important development that has come along in the past five years is that of digitizing measurements (converting in scaled, sequenced electrical pulses) and then using numerical computational techniques in subsequent accounting and automatic control. This introduction of what essentially is a digital computer into the process control system has great significance to batching operations such as paint making. For one thing, it offers a means for vastly improving the precision of weighing and blending. For another, it suggests the ultimate control of paint formulations from pre-programmed master schedules on tapes or punched cards.

Man Behind the Method

From the aforegoing it is obvious that an engineer cannot be plucked at random from among the operating staff and put to work to carry out the over-all logistics of an instrumentation program in the typical paint manufacturing plant. However, if a man with the following credentials *is* on hand, thank your lucky stars and do put him right to work:

1 - He must be well versed in the fundamentals of measurement and automatic control theory.

2 - He must have some experience in the practical application of the devices to carry out measurement and automatic control.

3 - He must be aware of the basic categories of instrument and control hardware on the market and familiar with the sources for such equipment.

4 - He must be familiar with your process—with both its chemistry and physics.

5 - He should be well grounded in the engineering fundamentals of hydraulics, mechanics, electronics, and optics.

6 - He should be capable of employing mathematics in his work—preferably at the level of differential equations and above.

7 - He should be curious, inventive, resourceful and capable of "selling" his ideas.

If you manage to come up with someone which satisfies all seven requirements, you have a rare find: your company harbors a well-qualified Instrument or Control Engineer. Latest estimates have only a few thousand of these unique specialists in the United States.

However, available in much larger numbers are the engineers and technicians who satisfy the first four "must" requirements on our list of credentials. These are usually individuals who have gravitated into instrumentation through practical experience, rather than through the rare post-war curriculum set-up to serve this engineering-science by a few of our Universities. Many of these people have a background which equips them for quickly developing a "feel" for the analytical tools necessary to the classic, full-scale practice of control systems engineering.

Rarely, however, does the company just getting started with an instrumentation program have the needed specialist(s) on hand. How can it secure this man? One obvious way would be to lure him from other firms with salary and advancement incentives. But this individual is usually so much in demand that such a tack may be fruitless; he is literally "sequestered" by the larger, more-endowed companies.

A second, longer-range approach would be to seek the promising graduates in this specialty from both Universities and Technical Institutes. At the present time perhaps 1,000 graduate engineers reach industry each year with the proper fundamental training for the instrumentation field. A lesser number of semi-professional technicians, versed in this specialty, also emerge yearly from the post-high school Institutes that teach this specialty.

Find the sources, secure the well-trained neophyte, and then subject him to the proper orientation (instrument maker training courses for "hardware" and in-company indoctrination for process know-how). Within a year or two you surely will have the start of a program in instrumentation.

One more word. The Foundation for Instrumentation Education Education and Research was established to help you in this endeavor. It will be glad to provide advice and information on training in this field at any time.

PROCESS CONTROL INSTRUMENTS

Description and uses of various controlling devices of interest to the coatings industry are presented

By J. C. Hawkins*

INSTRUMENTATION for the control of process variables has, in the past 20 years, reached a high plateau of usefulness, particularly in respect to pneumatically-actuated control devices. In the chemical industries and in the petroleum refining industry, the instrumentation investment is usually 7 per cent of the total process equipment expenditure.

Although this same generality can not be made in the surface coating industry as a whole, process control instruments are just as important to it. It is the purpose of this article to discuss the present uses of such devices in surface coating manufacture and to describe other devices that may be of future interest.

Process Variables

The four process variables most generally controlled are temperature, flow, pressure and liquid level. Temperature is sensed by a thermal system that responds to the change in volume of a fluid confined by the system components (Fig. 1). The response can actuate a visible column as in the common glass stem thermometer, the pointer of a dial type indicator or the pen of a temperature recorder. Although these indications and records are of considerable importance in themselves, their greatest usefulness is achieved when the

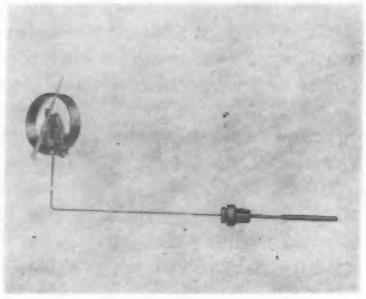


Figure 1.

pointer or pen actuates a pneumatic control mechanism.

Pneumatic control mechanism are available in varying degrees of versatility. They are designed to use the measure of the sensed variable, temperature in the present example, to provide automatic, corrective action to a process so that the desired value of the variable will be held constant or will be changed according to a predetermined schedule. The most simple mechanism is called on-off control. This device will serve when the heat source can be left on fully for appreciable intervals of time without drastically changing the temperature of the material in contact with it. Such a system is shown in Fig. 2. A temperature record of such a system will be a series of ups and downs, the distance from one to the other depending on the overall characteristics of the process.

When a more uniform temperature is required, proportional or throttling control can be employed. Here the operation of the control mechanism is such that a steam valve, for example, is positioned somewhere between fully opened or fully closed, depending on the relation of the measurement to the control index pointer whose position indicates the temperature desired. For example, consider a steam-heated continuous hot water heater. In use, it quickly becomes

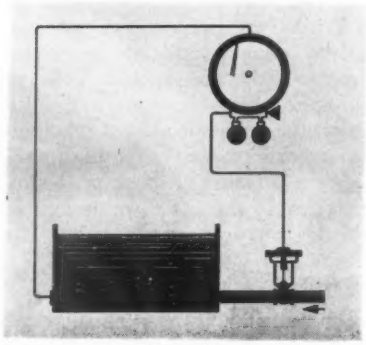


Figure 2.

apparent that for each rate of water flow through the heater, the pen will assume a new relation to the index of the controller. This obviously is because the steam valve must open more if more water is to be heated. And only by having the pen move farther from the index can a proportional control mechanism do this.

Of course, an operator could reposition the index sufficiently to bring the pen back to the desired value of temperature, for any given set of conditions. But the more complex the demands on the

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heat exchanger, the more impractical this becomes for the operator. To solve this problem, the proportional controller with automatic reset was devised. With the introduction of this instrument some 20 years ago, industry began to realize the full benefit of automatic control. Now it is possible, on most processes, to achieve a record of temperature continuously at the desired control point. Fig. 3 shows a modern controller of this type.

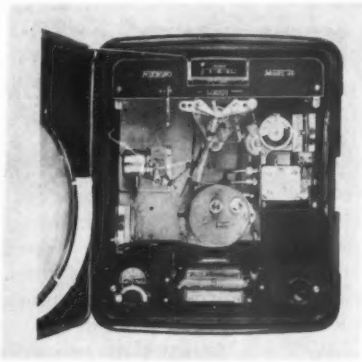


Figure 3.

However, more complex problems exist and a further refinement was added, known as derivative or rate action. Simply stated, it senses the rate at which the measured variable is tending to depart from the desired value and applies corrective action in proportion to the magnitude of this rate. The result is a method of control that can be described as almost anticipatory. It literally seems to outguess the process change and correct for it in such a way that the change never happens.

Cascade Control System

Derivative—the most complex of control mechanisms—overcomes the difficult problem of keeping a uniform temperature in a process that can only respond slowly to high increments of added heat. Such a system can absorb more than enough heat and, as a consequence, continues to climb after the heat input has been decreased. Take for example a gas-fired varnish kettle. Heat applied to the walls slowly works its way through the liquid to the temperature sensing element. Because of the relatively poor heat transfer of the liquid, the material at the vessel wall can be hotter than the material some inches deeper into the liquid. When finally the proper temperature is produced at the bulb, there is a considerable gradient across the liquid to the hotter walls of the vessel. As a consequence, even when the walls no longer receive external heat, the average temperature of the liquid will be well above the desired value.

Of course, if the bulb is relocated nearer the wall a colder area than desired will remain nearer the center and a true compromise will be difficult to achieve. Rate action control will help this situation. But even with rate action, the system may be capable of applying more heat at the walls than is safe for the product quality. If so, an arrangement of instruments as shown in Fig. 4 is used. Known as a cascade control system, this arrangement is widely used in controlling temperature of jacketed reactors and kettles. With such instrumentation, much of the polymerized resins and synthetic latex, of importance to the paint and varnish industry, is made.

Note that with a cascade control system the heating or cooling medium can be maintained within definite limits; so that even when a batch is started up, the contents can not be scorched or excessively chilled at the walls. This is done by limiting the extent to which the control index of the secondary controller can be positioned by setting mechanical stops in the instrument, usually a proportional plus reset controller. The master instrument is usually a proportional plus reset plus rate action controller and the output of the control mechanism only positions the index of the secondary controller.

Satisfactory temperature control requires many things of the instrument. When batches of material are to be heated it is apparent that for some time the temperature of the material being heated will be colder than desired. As a consequence, the automatic reset mechanism will reset the controller to such an extent that when the material finally gets to the desired temperature, the controller will be "late" in closing off the supply of heat and the temperature record will overshoot the control point. This can have a serious effect on product quality. The instrument manufacturer has provided a controller mechanism to eliminate the overshoot and the instrument sales engineer is ever alert to suggest its use and explain how it works.

Programming

A further ramification of the temperature control problem is the requirement that the temperature should follow a definite program or schedule of time and temperature variations. Customary for this application is the cam set controller shown in Fig. 5. A sheet aluminum duplicate of a recorder chart is cut to match the slopes and plateau of the time-temperature program. A cam follower then positions the index of the con-

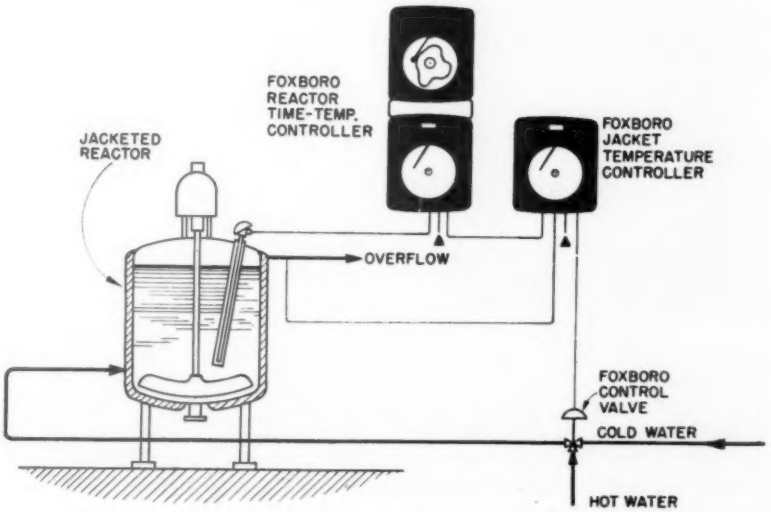


Figure 4.

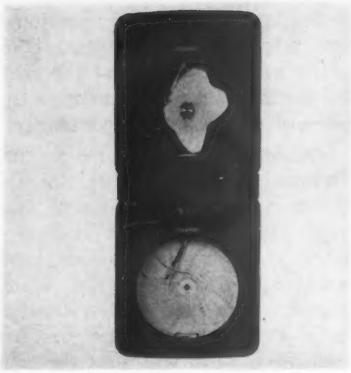


Figure 5.

troller and the desired values for the required duration are produced. Typical of the applications for this instrument is the process in which over and over again, the material is heated at a given rate of rise to a definite temperature, held there for the desired interval of time and then cooled at a fixed rate to some known end temperature. Occasionally a process will require a program of greater flexibility, in which case a camless controller is used. The cam is replaced by an electrically driven index. A timer governs the rate at which the index climbs or descends the scale and another timer governs how long any given temperature level will be maintained. This instrumentation, originally designed for textile dyeing applications, is finding many uses in all phases of process industry. A typical instrument is shown in Fig. 6.



Figure 6.

Fluid Flow

In all continuous processes and in many batch processes, measurement and control of fluid flow is of paramount concern. To measure flow, a suitable primary device is used to produce a pressure differential, and a means is provided for indicating or recording this differential.

The most frequently used primary device is the orifice plate. The orifice in the plate, Fig. 7, restricts the flow of fluid past it, causing the fluid to increase its velocity at that point. This change in velocity produces a decrease in line pressure just below the orifice. However, the pressure differential across the plate is relatively small, amounting usually to 100 inches of water or less (approximately 4 psi).

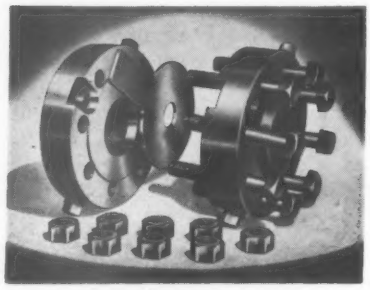


Figure 7.

Orifice plates are not always appropriate. If a liquid has a high viscosity or contains suspended solids liable to be trapped back of an orifice plate, it is customary to use a venturi tube as the primary device, Fig. 8. Venturis cause less permanent pressure loss

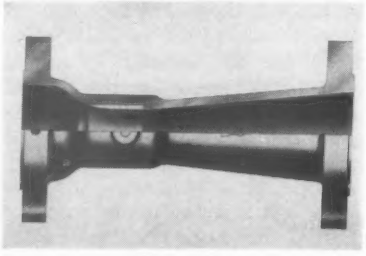


Figure 8.

in the system but they are costly in comparison to orifice plates (Fig. 9). Generally, they are used at low differentials from 50 inches of water down to 20 inches.

To sense precisely the differential of pressure across a primary device, the mercury manometer remains the standard. Most simply it appears as a glass U-tube, but for industrial use, instrument makers have devised a comparable, more rugged device (Fig. 10). In this instrument, mercury sits equally in the two legs when there is zero differential. As pressure increases in the float chamber, its

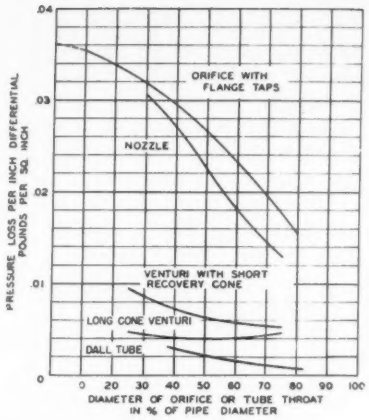


Figure 9.

mercury level falls, rising in the high pressure or range chamber. The resulting float motion causes the pen to move upscale. The relative diameters of these two chambers, in part, determine the range of the manometer system and hence the amount of differential that will cause full scale movement of the pen or pointer.

Well established data exists for calculating the exact amount of fluid passing the primary device. The instrument, in turn, is calibrated in terms of gallons per minute or, if a gas, in standard cubic feet per hour, to correspond to a given differential pressure, a certain size of orifice or venturi throat and the particular fluid in the line.

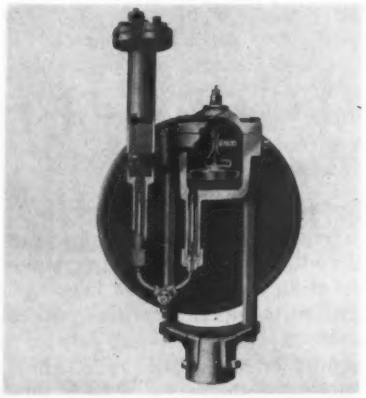


Figure 10.

By the nature of this calibration, only values from maximum flow to about one-third of maximum can be read precisely. This is termed the rangeability of a differential pressure actuated flow meter and is a characteristic of all such meters.

Although 3:1 rangeability is adequate for almost all control systems, there are ways of getting a so-called linear measurement of

flow that results in a 10:1 rangeability. The most common way is with a rotameter or variable area meter. (Fig. 11) A tube, of glass or metal, is slightly tapered from top to bottom. In the tube, a spool-shaped float of suitable material rises with increased volume of flow or sinks as the flow decreases. These devices also lend themselves to exact calibration, usually on a printed scale viewed through a transparent tapered tube across the top of the float.

Within the last few years a new instrument has been made available to measure flow of liquids. Working on the principle that a conductor, moving in a magnetic field, will generate a voltage proportional to its speed, this unique instrument—a magnetic flow meter

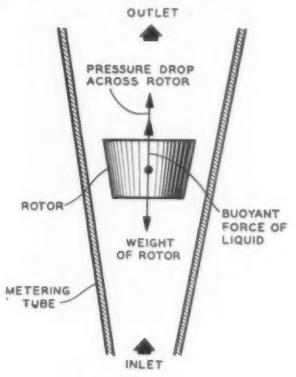


Figure 11.

—has had many new and interesting applications. It features an unrestricted section of pipe, Fig. 12, surrounded by an electromagnet in a housing.

Another type of flow measuring equipment involves an important phase of instrumentation known as pneumatic transmission. It is based on a mechanism that precisely senses a variable such as differential pressure and produces an output air signal whose pressure is exactly proportional to this variable. The most recent of these transmitters are described as force balance. In a force balance transmitter, a portion of the output signal is returned to a bellows which exerts a force on the transmitter in direct opposition to the force resulting from the sensed variable. The advantage of force balance design is that it permits small, compact transmitters of rugged and stable construction.

Typical of a force balance trans-

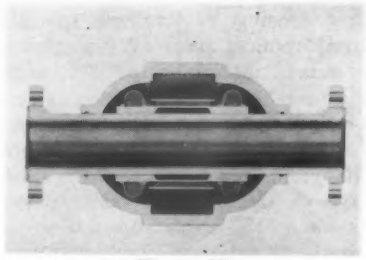


Figure 12.

mitter for differential pressure is the instrument shown in Fig. 13. Differential pressure is applied across a metal twin-diaphragm capsule and results in a 3-15 psi air signal linear with the differential pressure range of the instrument. Such a transmitter is, of course, used in conjunction with a suitable receiver to indicate or record and control. Because transmitter and receiver are linked by a length of conventional ¼" copper tubing, run at will by the user of the equipment, transmission systems permit central location of all recorders and controllers at one panel. Pneumatic transmitters are available for all the process variables important to the surface coating field.

Flow measurement and control have many applications in the surface coating industry. Fig. 14 shows a typical application of mercury manometer instruments in a linseed oil mill. The instrument on the right records and controls the flow of miscella; the other indicates and controls the solvent flow to the process. Not shown in the photo is a temperature recorder on the raw linseed cooker.

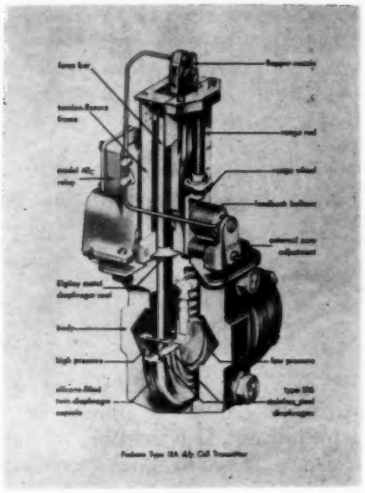
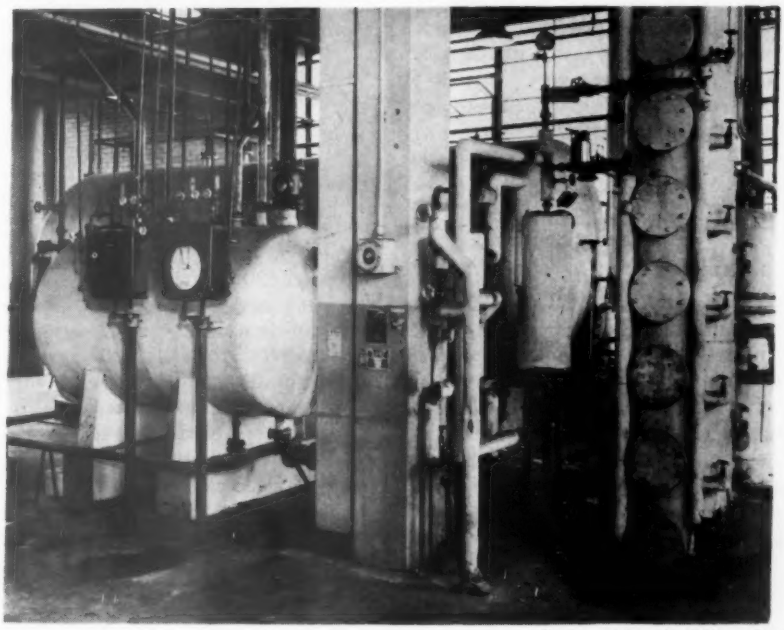


Figure 13.

Batching

Batching of liquid ingredients is another field of application vital to paint and varnish manufacture. Once a flow measurement is available, an integrator with a flow totalizer switch (Fig. 15) can be provided to shut off the liquid stream when a predetermined amount of material has been delivered. The sketch shows such a system using a differential pressure transmitter.



(Courtesy of Sherwin-Williams Co.)

Figure 14.

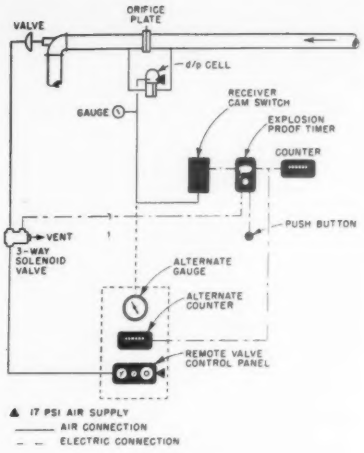


Figure 15.

When two or more liquid ingredients are to be mixed in a definite ratio, it is possible to control the flow of one ingredient in relation to another. The controller is provided with a mechanism that permits this ratio to be varied precisely, over a given range, to accomodate changes in formulation Composition of the flowing materials, or similar variables.

On occasion, the amount of one liquid stream may be so small that conventional size orifice plates are too large. A unique arrangement for the differential pressure transmitter, (See Fig. 13), known as an integral orifice attachment, permits very small orifices to be used without the need for costly, small size orifice plate holder assemblies. Fig. 16 illustrates the manner in which this is done.

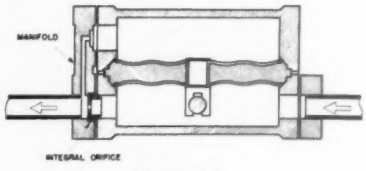


Figure 16.

Control of flow is a somewhat different problem from the control of temperature. A proportional with reset type of controller is generally used because the flow measurement, being essentially a measure of two pressures, responds quickly to changes in flow rate. Also, since a definite rate of flow is generally desired, this type of control is essential.

Pressure might well be considered as the basic process variable. Actually, temperature and flow sensing devices are specialized applications of, essentially, pressure instruments. As with flow and temperature, pressure can be indicated, recorded and controlled using the same types of dial indicators, larger recorders and control mechanisms. Much depends on the application. For example, a pressure controller may be directly connected to the process vessel if the material contained in the vessel will not plug the lead lines. If high melting materials solidify in the lines or polymerize and permitted to remain indefinitely stagnant, seals are usually employed.

A sealed pressure system (Fig. 17) looks much like a thermal system. At one end is the pressure element; at the other is a diaphragm attached to a suitable flange. Connecting the two is a length of capillary tubing. Back of the diaphragm is a cavity. The cavity, the capillary and the element are completely filled with liquid. Usually the filling liquid is kereosene but, when higher temperature are encountered, silicone oils can be used.

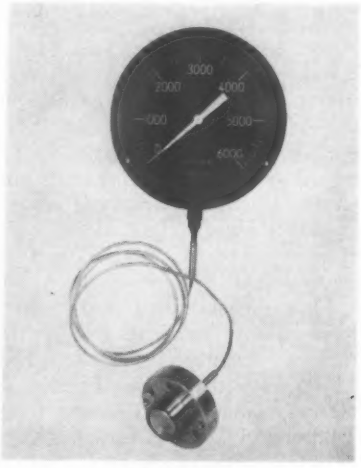


Figure 17.

Similarity to a thermal system, unfortunately, does not end with appearance. Seal fillings also respond to temperature and the design of the diaphragm must be such that expansion of the filling liquid will not impose a detectable pressure on the system. Of course, the expansion of the filling is more noticeable at lower pressures so a limit of 50 psi is set for this type of system. Size too is a factor. The higher the pressure, the smaller the diaphragm can be, resulting in a more compact process connection.

Pressure control is usually accomplished with proportional and reset action to insure a constant value. However, proportional control alone may be used if conditions permit it. For example, if the pressure in a vessel can be allowed to move through a definite range as narrow as two or three percent of the instrument scale, the relief valve will go from closed to fully open as the pressure reading moves upscale.

Pressure transmitters (Fig. 18) are very often employed, not only for the reasons already discussed but because it is safer not to expose personnel to the high pressure lines. Too, the vessel under pressure may contain gases that will corrode equipment or endanger personnel if leaks developed at the recorder.



Figure 18.

Liquid Level and Density

Closely related to pressure is the measurement of liquid level in tanks or vessels. Open tank level is readily determined and transmitted to a conveniently located indicator by means of a bubble tube system. An example is shown in Fig. 19. If the tank is under pressure, this system must be modified to remove the effect of static pressure from the level reading. This is relatively simple to do, using the differential pressure transmitter previously described. One side of the transmitter senses the pressure at a tap near the bottom of the tank. The other connection is made to the top of the tank, cancelling the

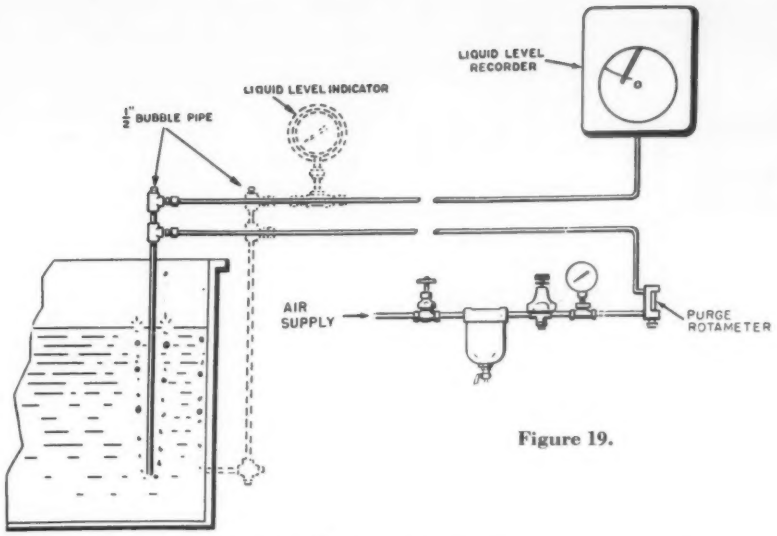


Figure 19.

effect of the static pressure (Fig. 20).

Level measurement is often needed in vessels containing viscous materials, heavy slurries or other liquids not suitable to small size pipe connections. A recently developed diaphragm type level transmitter is now available for these applications. It is shown in Fig. 21. Directly connected to the process vessel, it may be used for open tank applications or for systems under pressure or vacuum,

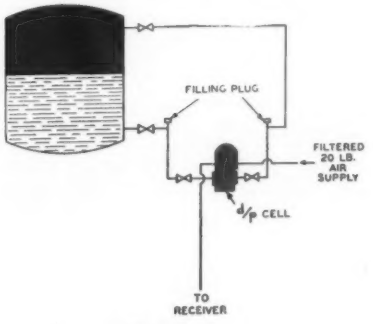


Figure 20.

and is simple to install and maintain.

When level is measured by a transmitter type of device, a simple, proportional type of control system is readily achieved. Fig. 22 shows such a system. As level tends to rise to the upper limit, the drain valve opens; as level falls, the valve closes. The valve will be fully open at the maximum level sensed by the transmitter. It will be closed at the minimum level. By selecting the proper range for the level transmitter, effective control of tank level is ob-

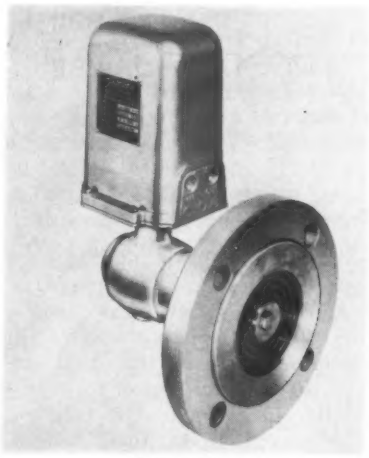


Figure 21.

tained. When a definite level must be held, the transmitter signal is applied to a controller of the proportional plus reset type and the exact depth of material maintained.

Liquid density can be measured by the use of low range differential pressure instruments. Fig. 23 shows a system which will detect density changes of the order of plus or minus .0010.

Electrical Process Control

Temperature

In the field of electrical process control, many precise instruments are available. Temperature measurements can be made with a resistance thermometer over much narrower spans than is possible with filled thermal systems. Temperature difference is readily meas-

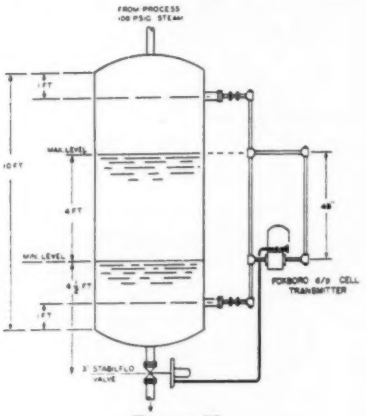


Figure 22.

ured. A standard instrument takes the temperatures at two separate resistance bulbs and indicates their difference to 0.25 percent of spans as narrow as 5°F.

This temperature difference instrument has been applied to the control of density in vacuum evaporators such as those used in the preparation of certain pigments and basic chemicals for the paint industry. It works on the principle that boiling point elevation results from an increase in dissolved solids concentration. By sensing the temperature of the boiling liquor in an evaporator and comparing

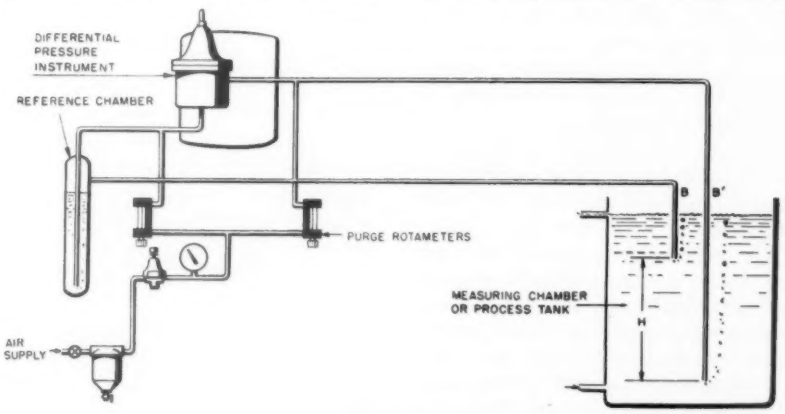


Figure 23.

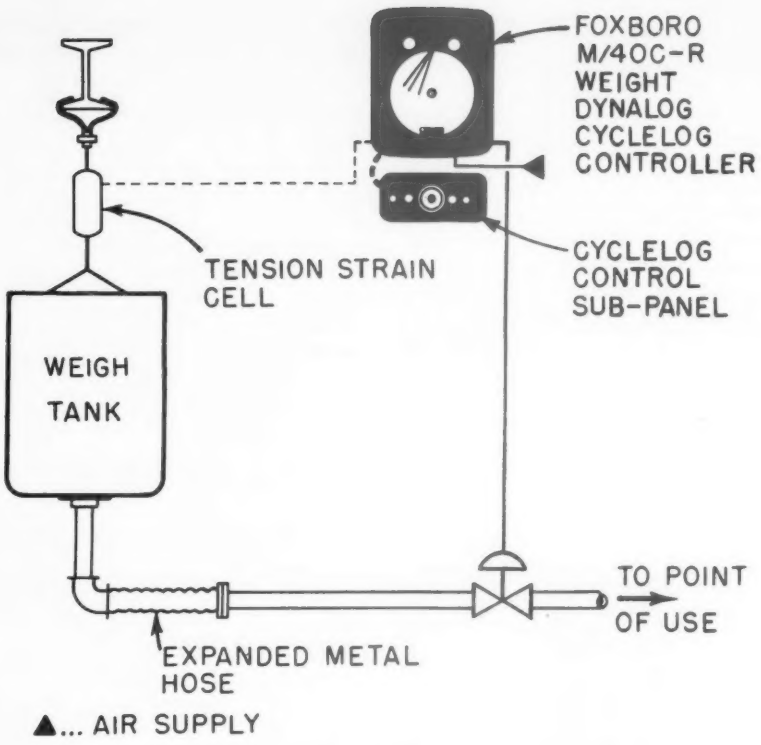


Figure 24.

it with the temperature of pure water boiling at the evaporator pressure, the boiling point rise is precisely determined. By controlling hold-up in the evaporator until the proper temperature difference is obtained, concentration of the liquor to a fixed value results.

Batching

Flow, level and density are sometimes used as indirect measures of the weight of materials desired in a batch. However, batching by weight can be accomplished directly by using electric weigh cells (Fig. 24). In principle, these cells use a minute change in dimension of the steel column at their center to change the electrical resistance of a system of very fine wires attached to this column. With the appropriate electrical circuit available in standard instruments, this resistance change is made available to record and control the weight in a tank supported by one or more weigh cells.

In spite of the apparent delicate nature of the fine wires at the heart of the weigh cell, these units are extremely rugged and have proved trouble-free and reliable in many applications. Capable of use wherever platform scales have been employed, they have demonstrated remarkable savings in maintenance over their mechanical counterparts.

A complex variety of operations is possible with electric weigh cells. Equipment has been built that permits precise additions of relatively small quantities to batches totalling a thousand times their weight. Sequences are set up that will proceed automatically once an operator iniates the cycle. Additions or withdrawals can be incorporated into the sequence and a truly versatile system can be engineered to fit the manufacturer's needs.

Electric weigh cells will respond to any force imposed on them, hence it is necessary to arrange their location carefully. Side thrust and forces other than those directly reflecting the weight of the vessel in question must be eliminated. The most common way is to suspend the tank from a single tension cell. But multi-cell supported tanks are also in use and good engineering can produce the required support system.

Mechanical load cells can also be used. In this cell the thrust of a piston of calculated diameter produces a pressure in an hydraulic system. The resulting pressure is proportional to the force on the piston (weight). Recently, mechanical load cells have been coupled with electrical pressure transmitters. This tends to simplify the weigh system because mechanical load cells are almost free from response to side thrust. At the same time, the advantages of narrow elevated ranges, multiple cell summations and the inherent flexibilities of electric cells have been retained.

Other process variables can be determined with electrical instruments. Often, where there is a choice between mechanical and electrical types, some one unique feature of the electrical instrument will more than repay the relatively higher investment. In other cases, a process variable can only be measured electrically.

Typical of an electrical instrument that offers application advantages is the magnetic flow meter described previously. Applicable to conductive liquids such as latex, Fig. 25, the meter is easy to install and simple to maintain. A Foxboro Dynalog Recorder, centrally located on a panel, provides a continuous record of latex flow through the two-inch line. Unaffected by turbulence in the line, the meter is close-coupled for piping economy. Because of the unrestricted metering section, no additional pumping losses are imposed.



Figure 25.

Viscosity

Viscosity is measured by an electrical instrument that is unique and does not have a mechanical counterpart. There are two well

(*Turn to page 166*)

AUTOMATIC MATERIAL HANDLING

Equipment and methods for accurate proportioning of liquid and solid materials

By Lawrence Lowy*

NOT many years ago the idea of providing equipment to continuously and accurately meter and feed materials to industrial processes was considered extravagant. First of all, demand was such that batch methods easily fulfilled production needs. In addition, labor and floor space, both essential to batching, were inexpensive.

The tremendous impact of World War II and the postwar years—the emergence of the automation concept—suddenly imposed gigantic demands on production facilities. Designed plant output, once believed only a supreme optomists dream, was soon stretched to the bursting point. The old batch methods had to give way to continuous processing; labor costs, once an inexpensive item became excessive; quality control, accuracy and uniformity of product assumed an importance never before considered.

The smaller industries, those whose output is measured in pounds and gallons rather than tons and barrels, had a stake in this too. All too often the attitude has been one of shrugging it off and allowing that all this has a place in the steel mill or cement plant, oil refinery, refrigerator plant, etc. Not so! It can provide advantages for smaller and more diversified industries like food, pharmaceutical, clothing—even the paint industry, too.

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For years the standard for mixing has been the "pot and paddle". It has been refined to a point where many feel it has provided the most in efficiency and economy. Anything to alter this concept is usually thrown out because it appears "too complicated", "too expensive", or applicable only to "large scale production". Yet it offers tremendous advantages if it is properly applied. One of the prime requisites in such a system is the accurate proportioning of the ingredients that go into process to produce the end result, be it oil, paper, soap, paint, fertilizer, cake mix, chemicals, pharmaceuticals or the million and one other items that go to make up our daily lives.

What are the units and how are they designed? What are their special features or advantages? The purpose of this article will be an attempt to answer these questions. It is not possible in this space to cover all the possiblities, however, the basic devices will be touched upon.

Continuous Proportioning

It will be well at this point to establish the meaning of continuous proportioning. Applied to a chemical compounding process it relates to the continuous uniform feeding and/or metering of the materials that go to make-up a blend in the proper ratio so that any increment at any instant will contain exactly the proper proportion of all components. The problem then is to establish these ratio requirements, determine the form in which the material is to be fed and select the equipment which will feed and meter the ingredients within the tolerable accuracy limits. This should preferably be done with a minimum of handling and a minimum of conversion from the state in which the materials are received.

In a batch operation, the metering of materials to the kettle is carried out in a variety of ways. For instance, the operator fills to levels or utilizes meters with automatic cut-offs to measure the individual ingredients. He may preweigh or preload the required quantities of materials and at the proper moment in his cycle discharge from intermediate storage to the tank. There is also the possibility of metering pumps and solids feeders automatically controlled as to cycle duration and either energized in sequence or controlled by the operator. Any or all of these methods can be applied to a continuous proportioning system which makes the conversion from a batch to continuous system not too great a capital investment.

The disadvantages connected with the batch system are numerous. For one thing there is considerable lost time in tying up a tank which serves no purpose except as a temporary receptacle. It must be filled, mixed and sampled. Meanwhile production requirements must be met; the re-

sult is lack of tankage to maintain plant output. This means a heavy capital outlay in kettles and large sections of floor space for tankage along. Another factor to consider is the labor involved in the batch method. Much of the metering and quality control must be left to the operator—the "human element" is always open to error—and more often than not requires doctoring of batches or possibly even the "slopping" of the entire kettle.

Now let us examine the problem. In any feeding device which may also act as the proportioner or meter, the characteristics of material to be fed determine just what sort of equipment is needed. Is it solid, liquid or gas? We must know temperature, pressure, viscosity, density. Is it free flowing, lumpy, sticky, plastic, corrosive? Then what is it to be fed to? Where is it drawn from? Needless to say, these are only some of the considerations.

The two ways in which material can be fed is weight or volume. Volumetric measurements are susceptible to temperature in the case of liquids, temperature and pressure in the case of gases and moisture content and particle size in the case of solids. This method of feed, therefore, will not produce the accuracy available in gravimetric proportioning because the latter depends only on force of gravity. However, the volumetric feeder is often preferable because it is less expensive, accuracy limits are within quality requirements and temperature and pressure conditions are nearly constant.

Positive Displacement Pump

Probably the most rugged and dependable of liquid volumetric proportioning devices is the positive displacement plunger pump as seen in Figure 1. This takes care of discharge pressure conditions of any magnitude. Capacities are available from a fraction of a cc per minute to 50 GPM.

The pump itself consists of a motor providing a pump drive shaft speed of some RPM between 25 and 80 through either an integral gear head or separate speed reducer. This shaft normally operates a crank and a crank arm. Through the crosshead assembly this produces reciprocating movement of the reagent or fluid end plunger. A threaded crank allows manual adjustment of the crank arm to provide stroke length variations of the plunger for this same range producing a delivery range from O to maximum capacity. The crosshead guide is calibrated to indicate this setting. Normally these pumps are guaranteed within plus or minus 1% accuracy for a 10:1 range.

In the reagent cylinder as a precision ground plunger is withdrawn the preset stroke length through a stuffing box, a metered volume or solution is drawn through the suction line. With plunger motion reversed, the suction valve closes (valves are normally of the ball type) and the volume is forced through the discharge check valve, to the point of application. Since the pump is of the reciprocating type, a pulsating flow will occur. This effect can be reduced or almost eliminated by use of two or even three pumps mounted on a common baseplate with discharge strokes exactly out of step or installation of hydraulic dampers or surge chambers.

Units of this type can be furnished in special metals, rubber, plastic or ceramic thereby making them suitable for handling any chemical. In addition, either stroking rate or stroke length can be controlled remotely producing capacity adjustment according to variation in flow, pH, viscosity or any other process condition.

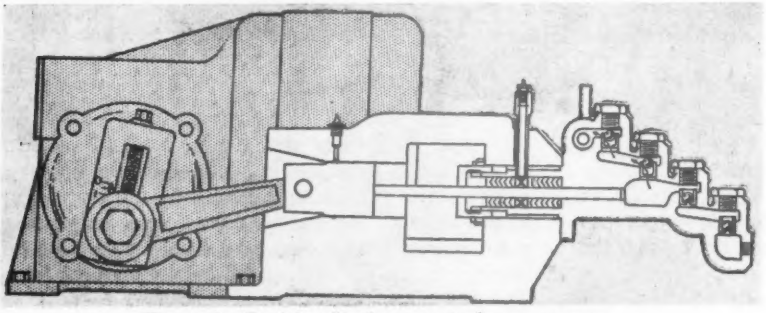


Figure 1. Positive displacement plunger pump.

Figure 2 illustrates the same principle but instead of a solid plunger, the fluid motivating force is applied by a diaphragm actuated either by a plunger or hydraulic fluid. The advantage in this type of positive displacement unit is the elimination of chemical packing. The diaphragm acts as a gasket too and tightly seals the reagent cylinder. The diaphragms are normally neoprene or rubber, but recently special materials such as plastics and metal alloys have been used effectively.

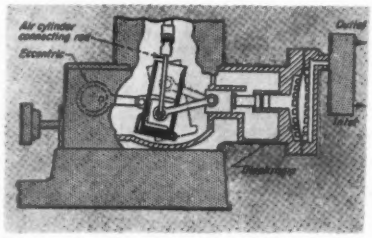


Figure 2. Positive displacement diaphragm pump.

Figure 3 shows a modification of the motor operated positive displacement pump described above. Instead of motor and crank drive this unit is pneumatic or hydraulic powered. The reagent plunger is directly operated through the connecting rod by the air piston (a). The power medium (air, steam, oil) is admitted alternately to either side of this piston through ports at "X" and "Y" by means of a pilot valve normally operated in proportion to main line flow (see Figure 3A) but often in response to some other process variable. The piston movement is limited by the position of the adjustable stop (b) and this can be set for 0 to maximum stroke length by means of the micrometer threaded shaft running from the piston to the handwheel (c). A counter geared to this shaft reads stroke length in increments of 0.01". Capacity settings are made by reference to delivery curve furnished with each unit. Since delivery is represented by a straight line function, stroke setting for desired output can easily be read and set by handwheel positioning of stop. Smooth cushioning of the piston at the end of each stroke is provided by means of the fixed and floating dashpots having adjustable bleeder ports.

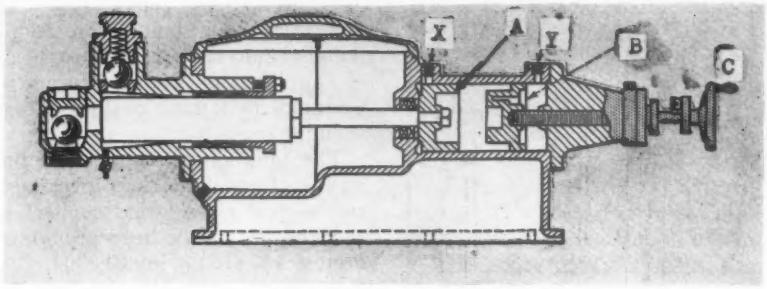


Figure 3. Fluid Driven Pump.

Both the crank driven metering pump and the fluid operated unit have been described. A basic difference exists between them. The clearance volume, that space still remaining in the reagent cylinder with the plunger fully forward in the completed discharge position, is extremely important in metering pumps for it determines if the pump will be self-priming or relieve itself of entrained air when discharging against pressure. As can be seen from figures 1 and 3, the ratio of total displacement volume to clearance volume will vary in the crank driven unit as stroke length changes are made, but it will remain constant in the pneumatic type.

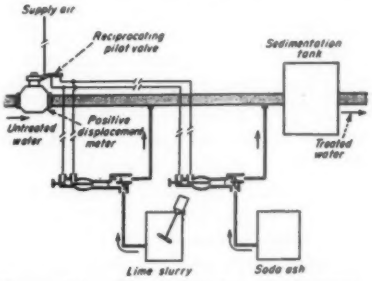


Figure 3A. Water treatment system.

The ratio for the motor crank pump will be high for maximum stroke (minimum clearance). When the ratio drops below an easily computed value ($P_1 V_1 = P_2 V_2$) the pump will not purge itself of air. In the pneumatic unit, since stroke length is controlled by limiting the rearward motion of the plunger, the ratio of displacement to clearance volume will remain constant for different settings. In addition, the motor driven unit will not reproduce capacity settings at low speeds because of such factors as fluid viscosity and check valve efficiency. The hydraulic unit will be uneffected by extremely slow speeds because each stroke is made at the same speed regardless of frequency. At high stroking rates consideration must be given to fluid viscosity, as sufficient time must be allowed on the suction stroke for the cylinder to fill before discharge is begun.

Up to this point, our discussion of volumetric liquid meters has covered units which provide the pumping phase too. However, many types of equipment are available for metering only, specially where large quantities are involved. This requires additional pumping facilities. In many process applications it is important to accurately meter the primary or largest component involved. The flow signal can then be used to pace all other chemical additions.

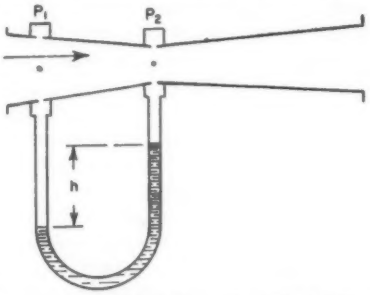


Figure 4. Differential meter (Venturi).

Volumetric Metering

Meters are of two types, differential or positive displacement. The differential meter (figure 4) utilizes a pressure drop across a fixed flow restriction to accurately indicate flow. The differences in pressure readings as taken at the throat and approach are proportional to the square of the flow. The Venturi tube represents the most accurate shape for this type of meter and also gives the greatest pressure recovery. A more common form of differential unit is the orifice plate (figure 5). In meters of this type the pressure differential is used to actuate a float or force balance device which in turn, through a square root conversion unit will produce a mechanical movement of a pen arm, indicator or totalizer or will transmit a time duration impulse or pneumatic signal proportional to flow. The electrical or pneumatic signal thus transmitted can be used to position feed rate controls for secondary proportioning devices (such as the positive displacement pump previously described).

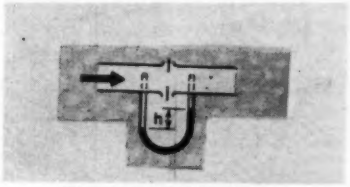


Figure 5. Orifice Type.

Another type of differential meter utilizes a variable orifice and fixed differential (figure 6) in which a float in a tapered tube assumes a position above the zero reference point according to flow rate.

Differential meters are not universally suitable for viscous liquids, suspensions or slurries. Compensations must be made for changes in specific gravity as viscosity changes affect the differential. Any deposit or build up on the edges of the orifice plate will introduce errors. Despite these specific drawbacks the differential meter is extremely useful and has wide application in industrial and municipal flow metering applications. In fact it provides the only method to meter fluid and gas flows where pressure loss is a major consideration.

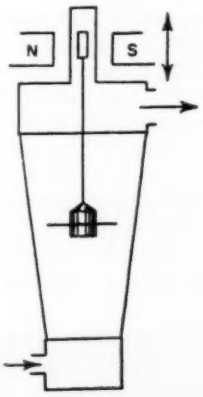


Figure 6. Rotameter (tapered tube).

The volumetric displacement meter differs from the differential type in that it uses volumetric filling of meter chambers located directly in the flow line. The liquid,

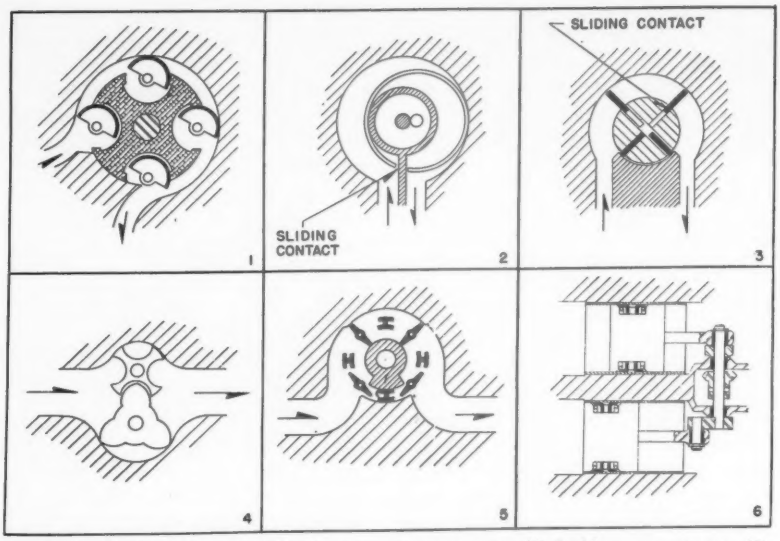


Figure 7. Typical types of displacement meters are (1) half-moon rotary, (2) oscillating piston, (3) sliding vane rotary, (4) two-spiral fluted rotor, (5) conventional vane rotary, (6) conventional piston.

in addition to filling the meter chambers, also drives the meter; knowing chamber capacity, the meter RPM can be used to operate a totalizer or control mechanism with suitable step down in output speed. The meter chambers have such forms as shown in figure 7. It may be the pocket formed by the meshing of gear teeth or the compartment formed by the oscillating piston, eccentrically guided, or by the section formed by radially guided vanes.

A considerable pressure drop occurs across the positive displacement meter. Where metering pressure loss may be in the range of less than a foot to 5 feet in the differential meter it can go as high as 15-20 psig in the positive displacement meter. In addition, viscosity or pressure variations will change the volumetric efficiency and accuracy of the positive displacement meter because of the clearances which must exist bebetween the moving parts. Some fluid will always "slip" past this clearance and this effect will vary with changes in material conditions.

Gravimetric Proportioning

In subsequent pages we will cover the various methods by which the equipment being described can be tied into a process system. Thus far, the discussion has been primarily concerned with volumetric metering for liquids. Now let us consider gravimetric liquid proportioning.

Liquid Feeders

Any continuous gravimetric device consists of four basic elements; The first is the load detecting and support means such as a suspended hopper, a weighing platform or a traveling conveyor belt. Then the load must be sensed and transmitted; this is performed by a scale level system tied into a mechanical hydraulic, pneumatic or electric transmission system. The load signal deviation from set point must then be compared and counteracted in order to maintain the system in balance; the force required for counterbalancing activates the fourth element, the control device that sets the rate at which feed is taking place.

In essence the system operates so that any deviation from a balanced operation is immediately *sensed*, *compared* to the reference point and *corrected* by speeding up or slowing the feed rate.

An application of this type is shown in figure 8. Its particular service is in the addition of tetraethyl lead to gasoline, but its principle of operation can be applied to any liquid feeding problem in which extreme accuracy is of great importance. This might be due to product specifications, expense of the material or hazard involved.

A tank of tetraethyl lead is scale mounted and represents a complete railroad tank car delivery which eliminates any primary storage problem and reduces handling of this very toxic fluid. An additional requirement of this particular application is that any conveying of TEL must be done under vacuum.

The tank is scale supported by means of one first class lever and two second class levers connected to a precision scale head providing accuracies of 1# in 10,000#. A flow signal from a Venturi Tube in the gasoline line transmits either an intermittent electric signal of 0 to 13.3 seconds every 15 seconds or a pneumatic pressure of 3 to 15 psig proportional to gasoline flow to the scale head to retract a finely threaded poise screw.

The system operates on a null balance principle requiring the scale to maintain balance at all times. As the poise is drawn back along the screw it reduces the scale beam load indicating a lead demand. A linkage at the tip of the scale beam senses this deviation

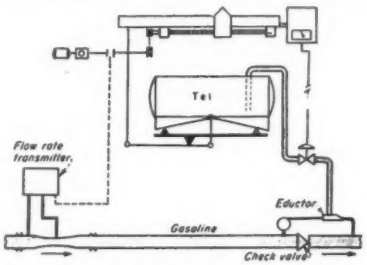


Figure 8. Proportioning of TEL to gasoline.

from the null balance position and alters the air output from an air controller operating on the "nozzle-flapper" principle to correct or reverse this movement. This air signal goes to the control device, a diaphragm motor valve with streamlined plug, and, in the case of a lead demand, increases air on the valve to open it wider and allow more lead into the line. Actually the sensing and response is so rapid that an extremely smooth movement takes place when flow varies. Should the valve allow too much lead in proportion to gasoline flow, a reverse action takes place. The poise now lags the scale demand and as a result the beam will drop; the air controller will reduce pressure on the valve and it will throttle. In every case as soon as the upset is corrected the valve assumes a new balance position correct for altered flow conditions.

This same arrangement is used

in continuous production of soap detergent. Oleum, fatty oil and glycerine are all fed by weight on the same loss in weight device as described above. However, instead of requiring time out for loading every time a weigh tank runs down, there are two scale mounted tanks for each component, each having sufficient capacity for a 4 hour run.

One tank is manually loaded at operator's convenience while the other is tied into the loss-in-weight operation. The tanks are shifted when one nears the finish by means of a lever arm and the now full and balanced tank is shifted to controlled feed from the loss-in-weight scale. In addition the three individual loss-in-weight feeders are proportionally controlled for a constant feed rate from a master drive source delivering a constant rate input through a variable speed driven Master Selsyn motor. The poise retracting screw for each one of the loss-in-weight scales is driven by a secondary Selsyn. Changes in formulation are made by adjusting an integrating type variable speed device between the individual component selsyns and the poise retracting screw.

While this description has covered liquid feed, the same arrangement would apply on the loss-in-weight feeding of dry materials.

Solids Feeders

Now, since we are examining the gravimetric feeders, let us proceed to a review of the gravimetric solids feeders. As pointed out before for the liquid gravimetric device, the basic requirements for any continuous weighing feeder are 1) load detection and support, 2) load reduction and transmission, 3) counterbalancing and 4) control device.

Figure 9, illustrates a solids gravimetric feeder. Again the load is scale mounted, but instead of having the scale support the whole load, it carries merely a small part of it. By means of a short endless belt the live load is continually replaced from a supply hopper and discharged to process. This again is a null balance arrangement in which the belt is set to maintain a constant weight; by varying the belt speed, control of feed rate is accomplished. This is the usual arrangement for the various weigh

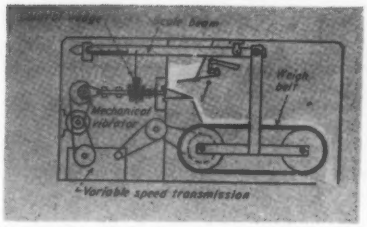


Figure 9. Belt (mechanical vibrator) solids gravimetric feeder.

belt feeders available on the market. They differ in the method by which feed to or from the belt is controlled should the scale deviate from the balance position.

In the case of the unit shown in figure 9, a vibrating movement is imparted to the feeder tray by a cam operated oscillator through a rubber wedge which hangs freely from the scale beam between the oscillator jaw and the opposing jaw which is attached to the feed tray. When the beam and control wedge drop because of insufficient live load on the belt, the vibrating tray amplitude is increased, causing an increase in the material fed to the belt. A movement of the scale beam in the opposite direction due to too great a load, the wedge is retracted and feed tray amplitude is decreased with a resultant reduction in material feed. Since a 1/8" vibrator movement of the tray produces maximum feed, the feeder will respond to the most minute fluctuation of the scale beam. The momentary contact of the oscillator jaws with the wedge does not affect the beam sensitivity. A regulating knob at the oscillator mechanism adjusts the jaw opening at the proper distance so that the scale beam will be level or "neutral" when the wedge has engaged sufficiently to effect the proper feed of the particular kind of material being handled.

An arrangement often used when materials are known to flood continually, is the use of a rotary feeder above the vibrating tray. This provides positive shut-off from the supply hopper when rotor is stationary. Excess material that may tend to back up on the vibrating tray is merely returned by the rotor back into the supply hopper.

Solids by Volume

The metering of solids by volumetric measurement is far more common than feeding by weight. This is partly due to the fact that the cost is usually considerably less, accuracy need not be so critical and ruggedness of equipment is essential.

Star Type

The star or rotary pocket feeder is shown in figure 10. It consists of a drum with a series of equally spaced pockets around the periphery. The drum is mounted below the hopper and between spring loaded pressure plates. Feed rates are proportional to RPM of the

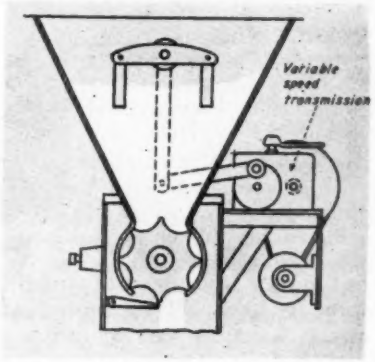


Figure 10. Rotary pocket feeder.

drum. Rotors of varying pocket design provide for different materials and rates of feed. Pockets can number from 5 to as many as 60. Outside scrapers or inner metal balls are used to knock out any material that may stick to the rotor after discharge. An additional advantage to this type of solids feeder is that it can operate against a small pressure differential. The drum drive shaft, in this instance, is packed where it passes through the housing. For the more delicate and accurate operations, pockets are machined to a high finish or chrome plated. For handling corrosive materials, the rotor and housing can be rubber or plastic coated.

Screw Type

The screw or spiral feeder provides another volumetric measuring and feed device often used for finely ground and granular materials. Figure 11 shows a simpli-

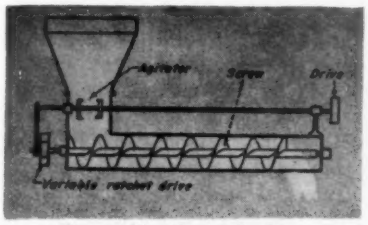


Figure 11. Screw feeder.

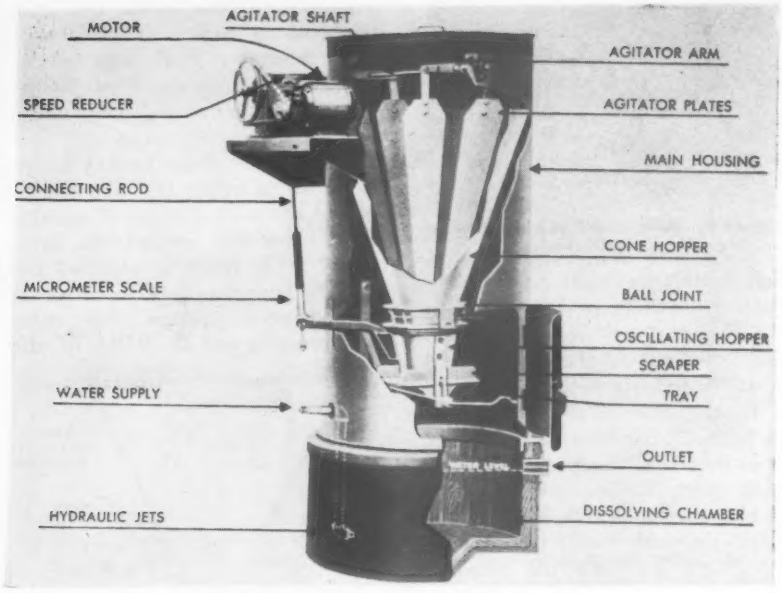


Figure 12. Reciprocating feeders.

fied form. Adjustment of variable speed control will establish feed rate. A simpler feed control is a ratchet drive. The unit shown uses 2 ratchets driven alternately by an oscillating arm with a variable throw adjustable from 0 to maximum. Screw motion produces two separate movements of the spiral.

Reciprocating Type

Reciprocating or oscillating feeders form another variety of the volumetric feeder. Figure 12 portrays one such unit. A constant speed motor, operating through a speed changer and connecting rod, drives a ball jointed, dust tight oscillating throat at the base of a conical hopper. A horizontally fixed, but vertically adjustable, receiving tray controls the gap between throat and tray for coarse feed setting. A scraper riding on the tray is reciprocated by throat oscillations and as it moves, it alternately pushes a preset volume of material from either side as it flows from the supply hopper. Fine feed adjustment is made through micrometer screw adjustment of the connecting rod mechanism controlling crank arm throw.

In all of the solids feeders under consideration means are usually provided to agitate the supply hopper material to prevent arching or packing. This can be plates hung in the hopper, or rotating arms or scrapers normally powered from the primary drive source through suitable linkage or pulleys.

Plow and Rotating Table Type

Still another class of volumetric meter is the plow and rotating table type or vice versa, fixed table and rotating plow feeder. One such design, as seen in figure 13, is a grooved plate rotating at adjustable RPM and riding past a fixed plow. The groove is machined to a known capacity per unit of length and as the groove emerges filled from below the hopper, it is struck off level with the disc. This is particularly suitable for feeding small quantities. Wire whiskers within the hopper act as agitators. For larger capacities the plate is flat and it carries material through an adjustable orifice before striking the plow.

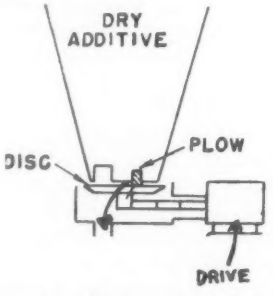


Figure 13. Plow and rotating table volumetric meter.

Vibrating Types

Another class of feeders is a type which vibrates or moves the material by throwing. Mechanical or electrical vibrators fit into this category. Figure 14 shows an electrically vibrated unit in which the power source is mounted below the feeder trough. Power is supplied by an electromagnet and armature. The armature is connected to a number of powerful spring bars. When AC or pulsating DC is applied to the magnet the armature is rapidly oscillated, first stretching the springs due to electromagnetic action then snapping back due to spring bar contraction. Bars are designed for size and quantity according to the inertia of the feeder so that power impulses will be applied at the natural frequency of the vibrating system. Actually the feed trough is pulled down and back from the load leaving it momentarily suspended. When the load falls it lands slightly in advance of its previous position. This produces an almost continuous flow. Feed rate is controlled either by setting the gate to regulate material level or by varying the

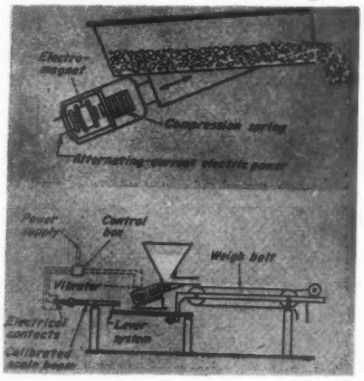


Figure 14. Electrical vibrator type feeder.

amplitude of vibrator through rheostat or suitable controller. Sometimes the magnet and spring bars are mounted above the trough when head room is limited. This type of feeder is especially suited to high temperature materials. The magnet can be sealed and even cooled. Materials which flood cannot be handled without provision for an anti-flood device located ahead of the vibrating tray.

The foregoing has covered only some of the feeders making up the wide range of metering device for continuous processing. Now, how can they be combined to effect a smoothly operating, continuous blending system.

Continuous Systems

Individually, any of the devices previously covered can be incorporated to feed to a batch tank.

However, today's trends are towards a completely integrated system whereby all of the various components can be simultaneously or successively fed to produce a continuous production of end product to be fed either to storage or packaging operations. The devices we have covered in this article can, therefore, be integrated in such a way as to produce this desirable end result.

In the former case where we take segregated items of equipment and tie them into a single source of control an arrangement such as that shown in Figure 15 can be utilized.

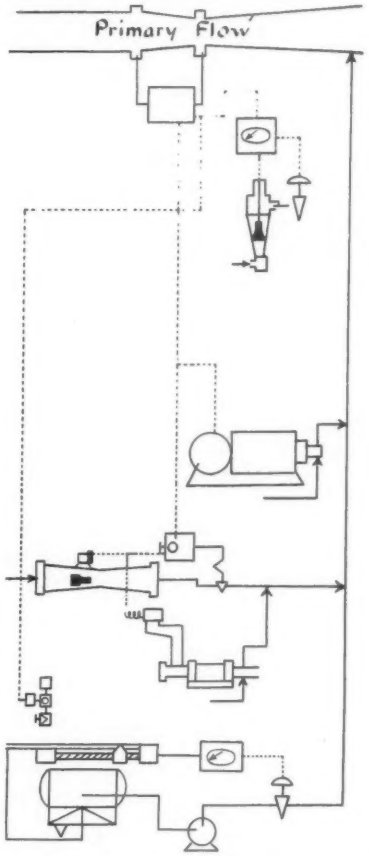


Figure 15. Single source of control arrangement in continuous systems.

For this one of our components or elements is used to pace the others. For example, in this case a differential meter measures a primary flow; the transmitted measure of this flow is used to pace various secondary feed devices as indicated.

In one case we use a rotometer and ratio control arrangement. The primary signal establishes a set point on the controller device which is manually set for ratio. The rotometer senses secondary flow and must match the adjustable set point as established by primary flow. To accomplish this the control valve will move to either increase or decrease flow into the line going to the manifold or primary flow line.

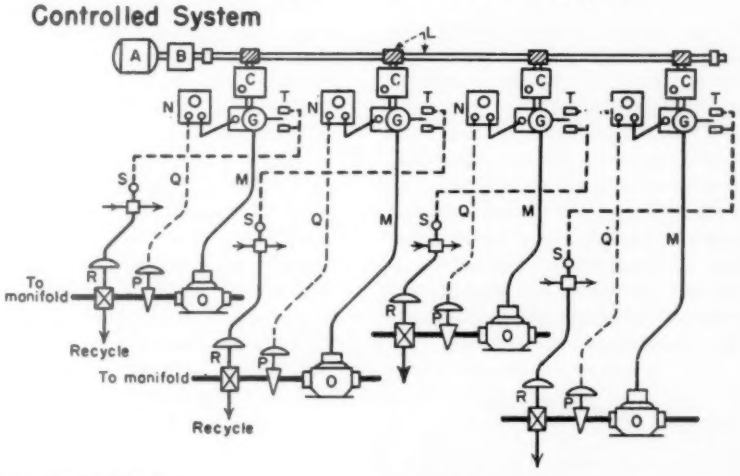
In the second feeder shown, the primary signal acts to adjust the output speed from a motor drive source stroking a positive displacement plunger pump. As our primary signal increases or decreases the output of the motor drive will be increased or decreased a proportionate amount. By setting the stroke length of the pump, the proper ratio of secondary to primary is established. The third case utilizes a velocity type meter whose output signal is matched against an input signal from our primary source in a ratio controller as shown in the first case and again a control valve is positioned in the outlet to bring the secondary stream in line with the paced signal. As an off-shoot of this system, we show a contactor device measuring rotary output from our velocity meter to stroke a pilot valve alternately feeding air to the suction and discharge ends of a positive displacement pneumatic pump to stroke this in proportion to output from our velocity meter.

In the last case, a gravimetric, loss-in-weight scheme is shown similar to that described in figure 8. Our primary signal controls the output speed from our drive source through the ratioing device to retract our scale poise in proportion to primary flow. At the outboard end of the scale beam the controller senses any deviation from null balance and acts to increase or decrease air pressure to the control valve receiving supply from our scale mounted tank feeding to the primary or manifold line.

In a system such as this, any individual stream is operating completely independent of any other stream. Should any upset occur the affect will not register on any stream but the one in which the upset has occurred. Unless suitable devices are incorpoarted the operation will continue without one of the necessary ingredients.

Where this feature is important, for instance should the blending operation go directly to packaging operations, it is essential that suitable arrangements be incorporated so as to signal any upset or shut down the operation in the event any stream is incapable of being maintained on control. To accommodate this arrangement a controlled system is recommended as shown in figure 16. Here the feed of all ingredients is integrated from a single source and any upset will act to either cause the operation to shut down or compensate for the error by slowing the output

(*Turn to page 167*)



BILL OF MATERIALS

A – Master drive motor
B – Master variable speed unit
C – Individual variable speed unit
G – Differential unit
L – Takeoff and drive shaft assembly
M – Flexible cable
N – Pneumatic controller
O – Positive control meter
P – Control valve
Q – Air piping
R – Recycle valve
S – Solenoid pilot
T – Limit switches

Figure 16. Controlled system in blending.

RHEOLOGY
and
VISCOMETRY

Fundamental rheological concepts and definitions as an introduction to viscometry and continuous recording viscometry

By Stanley Le Sota*

THE paint industry is becoming increasingly cognizant of the importance of measuring and understanding the rheological properties of paint. It is drifting away from "single point" reading viscometers and investigating the non-Newtonian properties of their products. Greater interest in trying to relate rheology to paint application is being shown as can be witnessed by the work of Asbeck, Laiderman and Van Loo (1) in which they relate high shear viscosity (12,000 to 35,000 sec.$^{-1}$) to brushing drag. This work was confirmed by the New England Paint Varnish and Production Club (2). Other Paint, Varnish and Production Club technical committees have recently initiated a number of rheological studies.

The aim of this article is to review some of fundamental concepts and definitions of rheology in outline form as an introduction to viscometry and continuous recording viscometry. A viscometer directory has been included to illustrate and describe the various types of viscometers, their units, range and principle of mechanism.

Viscosity Factors

Frisch and Simlia (5) list the factors that affect the viscosity of suspensions and solutions as:

(1) The shape, size and mass of the suspended particles or solute molecules
(2) The size or molecular weight distribution as a consequence of the above (1)
(3) The volume actually occupied by the particles in solution
(4) The internal flexibility and ease of deformation of the particles
(5) The thermodynamic conditions in the system
(6) The presence of electric charges in the system; and
(7) The concentration.

In regard to factor 5, Reiner (5) claims that rheology is separated from thermodynamics by the provision that rheological processes take place under isothermal conditions (e.g., placing viscometers in thermostatically controlled baths.)

Viscosity of Suspensions

Particles suspended in a liquid medium block the motion of the molecules of the solvent and produce an increase in viscosity. Einstein was the first to make a theoretical hydrodynamic analysis of such systems. For very dilute suspensions of rigid spherical particles, whose size is large relative to that of the solvent molecules, the Einstein equation is:

$$\eta_r = \frac{\eta}{\eta_o} (1+2.5c)$$

where: $\eta_r = \frac{\eta}{\eta_o}$ = relative viscosity

η = absolute viscosity of solution
η_o = absolute viscosity of the pure solvent
c = volume fraction of particles in the solution

Viscosity-Concentration Relationship

Arrhenius showed that the viscosity of suspensions varied logarithmically with the concentration and proposed the following equation:

$$\eta = \eta_o e^{kc}$$

where: η = viscosity of suspension
η_o = viscosity of the pure solvent
k = specific constant determined by solute, solvent and temperature
c = volume fraction of particles in suspension

This straight line plot is claimed to hold for higher concentrations (16).

Flow Classification

According to Green (9) there are four basic types of flow. These are:

Newtonian
Plastic
Psuedoplastic
Dilatant

Thixotropy is always present if there is a hysterisis loop.

Newtonian Flow

Definition: Type of flow characterized by a rate of shear that is directly proportional to the shearing force.

$$\eta = \frac{\text{shearing stress}}{\text{rate of shear}} = \frac{\text{dyne/cm.}^2}{1/\text{sec.}} =$$

poise

*National Lead Company, oil and Resin Laboratory, Philadelphia, Pa.

Equation: (Newton)

$$F = \eta \frac{dv}{dr}$$

where: F = shearing stress/unit area
η = coefficient of viscosity
$\frac{dv}{dr}$ = velocity gradient (rate of shear)

Examples: water, glycerine

Unit: Poise (dyne-sec./cm.^{2})

Reciprocal: Fluidity = $\frac{1}{\text{viscosity}}$, Unit = rho

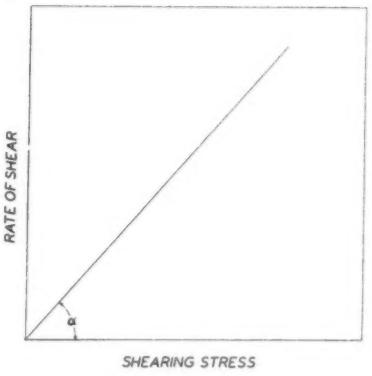


Figure 1. Newtonian Flow Characteristics-yield value-0, starts, at origin, completely linear, cotα proportional to viscosity.

Mechanism: Sir Isaac Newton's model of flow consists of two parallel plates with the space between them filled with test liquid. A tangential shearing stress, F, is applied to the top plate which then moves with respect to the bottom plate and carries with it innumerable parallel plates of test liquid. The top plane moves the greatest distance and the bottom plane remains stationary. Newton assumed that all intermediate planes between the top and the bottom planes moved in linear proportion to their distance from the top plane. This phenomenon is likened to pressing the finger obliquely downward on a stack of new playing cards and observing the regularity of slip. The bottom card remains stationary, the top card travels farthest. Each card represents a liquid layer (16).

Newtonian Liquids in Paints: Light mineral and vegetable oils give linear consistency curves and are generally classified as Newtonian. Viscosity measurements can be made with most viscometers and data can be converted from one system to another. However,

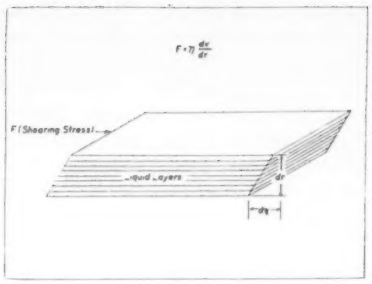


Figure 2. Newtonian Model of Flow.

high viscosity oils reveal non-Newtonian flow.

Gardner-Holdt "bubble viscometers" are widely used to measure the viscosity of these oils in the paint industry.

Solvents and thinners are also Newtonian and can be measured with capillary viscometers like the Ostwald or with efflux viscometers like the Saybolt.

Plastic Viscosity

Definition: Plastic viscosity (U) is the resistance to flow when the material has been subjected to a stress in excess of the yield value. Plastic materials are generally called Bingham bodies.

$$U = \frac{\text{shearing stress} - \text{yield value}}{\text{rate of shear}}$$

or

$$F - f = U \frac{dv}{dr}$$

where: F = shearing stress
f = yield value
U = coefficient of plastic viscosity
$\frac{dv}{dr}$ = velocity gradient (rate of shear)

Equation:

$$U = \frac{(T - T_o)S}{\omega}$$

where: U = coefficient of plastic viscosity
T = torque in dyne-centimeters
T_o = yield value intercept in dyne-centimeters
ω = angular velocity, $\frac{RPM}{9.55}$

Unit: Poise (dyne-sec./cm.^{2})

Reciprocal: mobility = $\frac{1}{\text{plasticity}}$ = analog of fluidity

Yield Value: (f) Minimum shearing stress that will cause flow in a plastic material (Bingham): the shearing force producing infinitely slow rate of flow between adjacent planes.

Equation:

$$f = T_o C$$

where: f = yield value
T_o = yield value intercept
C = instrumental constant

Unit: dyne/cm.^{2}

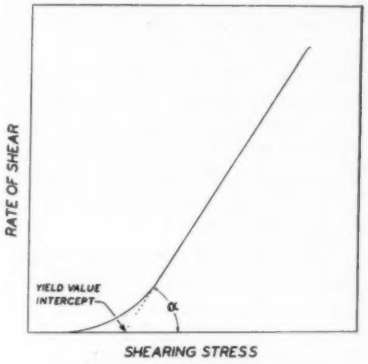


Figure 3. Plastic Flow. Characteristics-does not start at origin, has a yield value, cotα proportional to U.

Mechanism: Materials exhibiting plastic flow do not flow until an applied shearing stress exceeds a certain minimum value. They act as if a barrier had to be surmounted before flow can occur. This minimum shearing stress is designated as the yield value. When the yield value has been exceeded, laminar or streamline flow takes place throughout the mass of the substance (6).

A suspension showing plastic flow contains particles that touch each other, and the flow of the system requires, then, breaking of the contacts movement of the particles with respect to each other. Bingham (3) speaks of "arches" of the particles, distributing the stresses applied and contributing to the internal friction of the system. The particles form a reticulum or network of floccules which is broken during shearing. Reformation and breaking of the structure occurs duting shearing, and, if the rate of shear is held constant, the floccules no longer change in effective average grouping and achieve steady state.

Plastic Viscosity in Paints: Paints are, perhaps, the most frequently encountered examples of plastic flow. Gloss enamels, with low pigment content, show the least plasticity and thixotropy, outside house paints and semi-gloss enamels are intermediates; flat paints exhibit the highest plasticity (6).

For most commercial types of finishes, the evaporation of solvents proceed with resultant increase in plastic viscosity. After deposition of the coating, the surface is left momentarily with irregularities, and the related process of continued evaporation of solvent, leveling under the surface forces at the interface, and the gradual increase of viscosity begin. If the composition immediately after deposition exhibits a yield value (or a rapid thixotropic build up), the structure is set by the low mobility of the composition (7).

Weltman and Green (19) claims that not only plastic viscosities of pigment suspensions, but also yield values for suspensions of higher pigment are logarithmically related to the volume percent concentration.

Psuedoplasticity

Definition: Psuedoplastic materials have no yield value and the flow curve in non linear with the rate of shear increasing faster than the shearing stress.

Equation: Though empirical equations have been suggested and the curve for psuedoplastic flow can be expressed by power equations, no satisfactory equation that can be rheologically justified has been theoretically deduced.

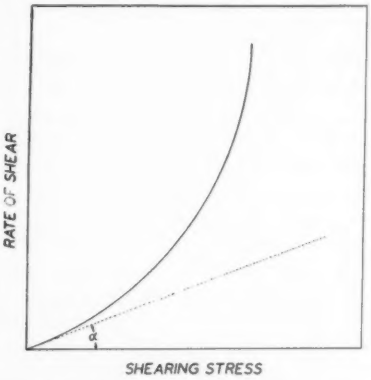


Figure 4. Pseudoplastic Flow Characteristics-starts at origin, nonlinear curve, convex curve, no yield value, cot α proportional to initial viscosity.

Unit: Poise (dyne-sec./cm.^{2})

Examples: Starch and methylcellulose solutions

Mechanism: Psuedoplastic flow is associated with the presence of swollen granules, solvation and aggregation. In the most common examples of psuedoplasticity, the dispersed phase is lyophilic, i.e., capable of absorbing and swelling in the liquid phase. The particles thus are appreciably solvated and may be pictured as surrounded by an envelope of the colloid-liquid complex. In a material that is capable of forming a gel, the boundaries of one particle merge with those of adjacent particles. As the mixture is sheared, the particles are distributed from an equilibrium condition and are deformed and oriented to some extent in the direction of flow. Some of the liquid associated with the particles may be separated, with the result that the particles themselves are effectively smaller; consequently, interaction during shearing is reduced and hence there is a decrease in resistance to shear. As the rate of shear increases, the extent of such change in effective particle size becomes greater and as a consequence, the apparent viscosity falls off (6).

According to Green (9), psuedoplastic materials are composed of long chain molecules. Under low rates of shear, the tendency of such molecules to align in the direction of flow is negligible. They remain, therefore, in a disorganized state in which case their rate of shear will remain practically proportional to the shearing stress. As the rate of shear increases, however, molecular alignment increases. This reduces the frictional resistance between adjacent layers and the result is a greater rate of shear for a given stress than would occur otherwise. This causes the curve to leave its linear course and bend upward.

Psuedoplasticity can be considered the reverse of dilatancy.

Psuedoplasticity in Paints: Resins, both natural and synthetic, often give psuedoplastic curves. They are characterized by showing no evidence of yield value, are highly viscous and sticky and are composed of long molecules (9).

Light mineral and vegetable oils give linear consistency curves and are generally correctly classified as Newtonian. With increasing molecular weight and chain length, the situation changes and consequently, heavy oils are invariably psuedoplastic.

Dilatancy

Definition: Any isothermal reversible increase in consistency or apparent viscosity with increased rate of shear. Dilatant materials are particle suspensions which are deflocculated and are in a settled state of minimum voids and thereby increases the resistance to flow.



Figure 5. Dilatant Flow Characteristics-starts at origin, onnlinear curve, concave curve, no yield value.

Equation: Though empirical equations have been suggested and the curve for dilatant flow can be expressed by power equations, no satisfactory equation that can be rheologically justified has been theoretically deduced.

Unit: Poise (dyne-sec./cm.^{2})

Example: Wet sea sand

Mechanism: At low shearing rates, the particles in front of the object causing the shear have sufficient time to slip over each other and "get out of the way". At higher rates of shear they cannot get out of the way fast enough. They pile up and become compressed in front of the shearing object, creating considerable resistance. Behind the shearing object the mass is "stretched". Liquid drains into the larger interstices of this less dense structure, and the mass appears dry. At the same time this draining of liquid away from the material ahead robs it of lubricant and still further increases the resistance to shear. The independent behavior of the solid particles causes the structure to disappear again as soon as the shearing force is removed (8).

Reynolds (15) explained dilatancy as a system where the particles settle to a state of minimum voids and that any disturbance causes rearrangement of the particles with a greater void volume. As a consequence the total volume of the suspension appears to increase or dilate. In a closely packed suspension, an increase in the space between particles causes

the suspending liquid to be drawn to the mass.

In some respects dilatancy is the reverse of psuedoplasticity.

Dilatancy in Paints: Green (9) states that dilatancy is quite frequently encountered in pigment-vehicle suspensions such as paints and printing inks. Paints and especially enamels that have been settling over a long period of time often have a layer of dilatant pigment on the bottom of the container. He also states that there is a common belief that dilatancy is the opposite of thixotropy, but thixotropy and dilatancy can exist in the same material at the same time.

Fisher (6) discusses the dilatancy of certain pigments in water and solvents. Certain concentrations of calcium carbonate, zinc oxide and barium sulfate are some of the pigments cited as dilatant.

The writer has found that 1% of borax added to a 10% aqueous solution of polyvinyl alcohol results in an extremely diltatan material, which upon shaking or stirring turns into a gel and liquifies upon rest.

Thixotropy

Definition: Gr. thixis (touch), trepo (change)

Isothermal gel-sol-gel transformation (Freundlich); breakdown of a reversible colloidal gel. (Conversion to a complete sol is a special characteristic and limiting case of thixotropy. This qualification permits paints to be classified as thixotropic.)

Equation:

$$M = \frac{U_1 - U_2}{\ln \left(\frac{RPM_2}{RPM_1}\right)}$$

M = Coefficient of thixotropic breakdown

U_1 = Coefficient of plastic viscosity at RPM_1

U_2 = Coefficient of plastic viscosity at RPM_2

or

$$M = \frac{4SA}{\omega^2}$$

M = Coefficient of thixotropic breakdown

S = Instrumental constant

A = Area of hysterisis loop.

ω = Angular Velocity, $\frac{RPM}{9.55}$

Unit: dyne-sec./cm.^{2}

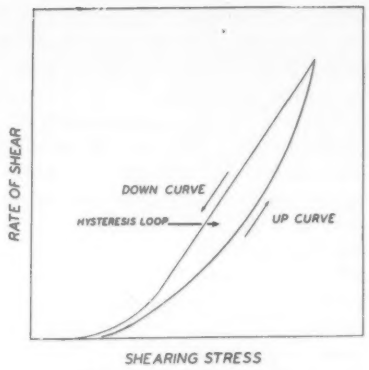


Figure 6. Thixotropy Characteristics-hysterisis loop, time dependency, thixotropy function of area within loop.

Examples: Wyoming bentonite slurry

Mechanism: A thixotropic gel, unlike a true gel, is a weak structure held together by secondary valence bridging (16). It is a structure which results from the interplay of forces existing within the suspension which operate towards balance in a stable equilibrium. Thixotropy is a formation of a mechanical structure or house of cards by orientation of the particles, which structure is readily altered by an external force, that is, the viscosity changes with increased velocity of motion.

Special Forms of Thixotropy:

Rheopexy—Some systems that form thixotropic gels possess the property of solidifying more rapidly when sheared (stirred) very slowly than when at complete rest. Presumably the slow stirring acts as an aid to normal diffusion in enabling the dispersed particles or dissolved chain molecules to arrange themselves into a scaffolding structure. Rheopexy should not be confused with dilatancy. The equilibrium state of the former is a solid gel, while the latter is a liquid. (16) Freundlich and Juliusberger (8) describe rheopectic material qualitatively as "a thixotropic sol, which may be solidified by gentle movement."

Reverse Thixotropy—Harvey Bulas and Fins (10) describe "reverse thixotropy" which they claim is closely related to thixotropy and resembling rheopexy in some respects but differing in others. Its basic attribute as defined by flow curves obtained with a rotational viscometer is an increase in yield value on continued shearing in the viscometer.

Negative Thixotropy—A reversible isothermal increase in viscosity during mechanical treatment. In negatively thixotropic systems, the field of flow displaces the equilibrium of the system from its state as a sol at rest to a gel state of higher free energy content which upon standing spontaneously reverts to the sol state. Negative thixotropy should also be distinguished from "work hardening" in which shearing only enhances the rate of the spontaneous process of crystallization, and from the phenomenon of dilatancy, which is due to a special rearrangement of rigid particles in suspension.

Thixotropy in Paints: Schmidt and Marlies (16) point out that the importance of thixotropy is aptly illustrated in paints. In a good paint the consistency should be high so that the pigment does not settle on standing; settled pigments form a hard mass difficult to stir back into homogeniety. The consistency at the same time should be low so that the paint is not difficult to brush out into a coat of uniform thickness. It must be able to "level" i.e., the consistency should be low enough for brush marks (ridges) to disappear (flatten out by flow) before the paint dries. At the same time, the consistency should be sufficiently high so that the paint will not run when laid on a verticle surface (curtaining) or sag or drip off the underside of a horizontal surface. A nice adjustment of rheological properties is necessary to meet these apparently conflicting requirements. As a matter of fact, they obviously cannot be met by other than a thixotropic system in which both the amount and rate of thixotropic effects have been properly adjusted. A good paint, when in a can, attains such a high consistency (false body or thixotropy) that the dispersed pigment does not settle out inordinately. Indeed, it has been found that, unless the paint is thixotropic, caking troubles are usually encountered. When the paint is sheared by stirring, spraying or brushing, the consistency drops considerably, making the paint easy to apply and permitting it to level, the paint thickens and sets up rapidly enough after application to prevent it from running down vertical surfaces.

Fisher (7) describes the relationship between thixotropy and brushing and states that after the brush left a layer of paint on the surface, several competing processes start: the paint begins to flow and the dispersed pigment particles begin to rebuild the original thixotropic structure. If rebuilding takes place quickly, leveling and flowing cease, and brush marks are formed. On the other hand, if the development of structure is protracted, flowout continues and the applied paint forms sag marks, particularly on the vertical surfaces. The balance between these properties establishes the performance of the paint. After deposition of the coating, the surface is left momentarily with irregularities, and the related processes of continued evaporation of solvent, leveling under the surface forces at the interface, and gradual increase of viscosity begin. If the composition immediately after deposition exhibits a yield value (or rapid thixotropic build-up), the structure is set by the low mobility of the composition.

Green (9) claims that the phenomenon of thixotropy has always been associated with structure. It should not be assumed in the case of thixotropic paints that this structure is necessarily one arising from pigment flocculation. It is probably true that pigment flocculation is a prerequisite for thixotropy, but it is not yet proven that the pigment structure is the actual thixotropic structure. Since the time interval for the formation of a thixotropic structure is a relatively large one, it is reasonable to assume that either some form of particle orientation or of particle readjustment is involved in the process. The particle in question might be the pigment particle or it might be the polymerized molecule of the vehicle.

Viscometry

Owing to the enormous range of rheological properties exhibited by various materials, no single instrument could be universally applicable. Besides the instruments required for precise scientific measurements, many devices for making rapid empirical evaluations are highly useful in industrial practice (16).

Although, in many cases, the accuracy of a viscometer leaves much to be desired, the speed and simplicity may be more important for a control laboratory and thereby determine its choice.

The choice of a viscometer depends upon a number of factors, but essentially should be determined by the rheological properties that are to be measured. If the material is Newtonian, capillary or efflux types may be suitable; however, if the material is non-Newtonian, single point readings become meaningless. In this case, a rotational viscometer should be used. The type of rotational viscometer should be determined by the paint property the rheological property is to be correlated with. For example, Asbeck, Laiderman and Van Loo (1) point out that brushing shear range from 12,000 to 35,000 sec.$^{-1}$ and in order to correlate brushing drag against rheological properties, the viscometer to use should have a shearing rate comparable to that of the brush.

Many materials, generally thought of as being Newtonian, are not. Light mineral and vegetable oils are generally Newtonian and can be measured by viscometers designed for Newtonian liquids. However, many high viscosity oils reveal non-Newtonian flow and should be measured with a rotational viscometer.

Units:

There are many viscosity units as can be illustrated by the many published conversion tables and nomographs. Most of these units are arbitrary, others are based on time measurements. The poise is the c.g.s. unit of absolute viscosity. A material is said to have a viscosity of one poise when a shearing stress of one dyne per square centimeter induce a unit rate of shear.

The c.g.s. kinematic viscosity unit is the stoke and is equal to poise divided by the specific gravity of the liquid.

Many of the viscometers have no precise theoretical rheological justification, however, most of the viscometers are based on one of the equations in Table I.

Viscometer Classification

There are many methods for measuring viscosity, some giving absolute and others relative values.

Weltman (20) classified viscometers for liquids into three classes:

1. Those that express the consistency of materials in arbitrary terms, values of which are calibrated against a standard material of known consistency. These would include the Gardner bubble tubes, extrusion type viscometers, Stoke's type viscometers as well as rotational viscometers employing a rotor and stator of such a design that a mathematical interpretation of the model of flow has not been achieved.
2. Those that can represent flow conditions mathematically and are not applicable to the study of non-Newtonian materials but Newtonian and liquids than can be tested at low shear.
3. Those that can measure consistency under controllable flow conditions and establish an accurate relationship between the shearing force and rate of shear.

Viscometers can also be divided into two principle types—those measuring force and those measuring time—these variables being related to viscosity according to the particular instrument used.

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Theoretical Instrumental Equations

Equation	Type of Flow Measured	Type of Viscometer	Viscometer Example
Poiseuille: $\eta = \frac{\pi R^4 F}{8LV/t}$ where: η = coefficient of viscosity; F = applied air pressure; L = length of capillary; V = rate of flow; t	Newtonian	Capillary	Ostwald
Couette: $\eta = \frac{TS}{\omega}$ where: η = coefficient of viscosity; T = torque; S = instrument constant; ω = angular velocity	Newtonian or Non-Newtonian	Rotational	MacMichael
Reiner and Riwlin: (14) $U = \frac{(T - T_o)S}{\omega}$ where: U = coefficient of plastic viscosity; T = torque; T_o = intercept of curve on T axis; S = instrument constant; ω = angular velocity. Yield Value (f) = $T_o C$ where: C = instrument constant	Newtonian or Non-Newtonian	Rotational	Precision-Interchemical
Stokes: $\eta = \frac{2(\rho_b - \rho)gR^2}{9V}$ where: R = radius of the ball; V = velocity; ρ_b = density of the ball; ρ = density of the liquid; g = acceleration due to gravity	Newtonian	Falling Ball	Falling Ball

Table I

VISCOMETER DIRECTORY

The viscometers described in this viscometer directory can be generally classified as follows:

Type	Examples
Capillary	Ostwald-Fenske
Efflux	Ford Cup
Bubble	Gardner Bubble Viscometers
Rotational (torsional)	
Rotating cup	MacMichael
Rotating bob	Hercules
Rotating paddle	Stormer
Rotating disk	Brookfield
Cone and plate	Ferranti-Shirley
Perforated disk	Mobilometer



Figure 7. Brabender Plastograph

Brabender Plastograph
Brabender Corporation
Rochelle Park, N. J.
Type: Mixer-Dynamometer
Units: Brabender Consistency Units
Viscosity Range: O to 1000 Brabender Consistency Units
Description: This viscometer utilizes a balanced motor and gear box unit as a dynamometer. The concentric shaft of this unit supplies the driving force for the two rotating blades. The resistance of the test material creates a measurable thrust or torque which forces the housing of the dynamometer in the opposite direction to that of the shaft. A lever system is attached to the dynamometer housing which enlarges those movements of the housing in a definite ratio. This lever system is connected to a torque recording device.

Brabender Recording Viscometer
Brabender Corporation
Rochelle Park, N. J.
Type: Rotational—rotating cup
Units: Stormer grams, Krebs units and Poises

Viscosity Range: 100-950 Stormer grams, 60 to 135 Krebs units, 5 to 45 Poises
Description: The Brabender Recording Viscometer combines the principles of the modified Stormer and the MacMichael instruments. A cylindrical container is rotated at constant speed, the liquid within imparting torque to a paddle connected with a spring. A lever arm records the consistency upon a moving chart. Speed of rotation can be varied from 30 to 285 rpm.

Stress-strain curves obtained on this instrument are similar to comparable data from modified Stormer viscometer data. Unlike the Stormer, however, the recording viscometer can be used to obtain a continuous record of consistency.

Reference: Wicker, C. R., and Geddes, J. A., A.S.T.M. Bulletin 120 (January 1943), p. 411



Fig. 8. Brabender Recording Viscometer

Brookfield Synchro-Lectric Viscometer
Brookfield Engineering Labs.
240 Cushing Street
Stoughton, Mass.
Type: Rotational—rotating disk or cylinder
Units: Poises
Viscosity Range: 0 to 20,000 Poises (Model LVF)
Description: A cylinder or disk is rotated in the fluid under test through a beryllium-copper spring. The deflection of the spring is read on a dial. The dial reading is multiplied by a simple constant to obtain the resulting viscosity at the particular rotational speed. Measurements made at different speeds are used to describe the flow properties of the material at hand.

The angular distance by which the disk lags behind is indicated on a dial while the test is being made. The pointer or indicator on the dial scale may be held stationary by means of a clutch that clamps the dial to the pointer until released. The synchronous motor used to drive is then stopped and the reading is noted.
Reference: Shaw, A. M., Chem Eng., P. 116 (Jan., 1950)



Fig. 9. Brookfield Synchro-Lectric Viscometer

Drage Rheometer
Drage Products
406 32nd Street, Box 330
Union City, N. J.
Type: Rotational—Rotating Bob
Units: Poises
Viscosity Range: 0 to 30,000 Poises
Description: Within the outer framework of the Rheometer, there is a freely suspended synchronous motor, gears and axle bearing. The motor turns the spindle axle which is connected to the measuring bob. Depending upon the tenacity of the substance being tested, a greater or lesser friction is exerted upon the bob. This tenacity, which is linear to viscosity, is transmitted to the freely suspended motor, the movement of which is opposed by a calibrated spring. The motor will be deflected from its position of rest until an equilibrium is reached between the resistance encountered by the bob and the counter-force resulting from the tension of the spring. The pointer which is attached to the torque-reactive motor housing, continuously indicates the "at present" friction (viscosity) on the stationary and completely visible dial.



Fig. 10. Drage Rheometer

Fann V-G Viscometer
Fann Instrument Corp.
3202 Argonne Street
Houston 6, Texas
Type: Rotational—rotating cup
Units: Poises
Viscosity Range: O to 300 Poises
Description: Fluid is contained in the annular space between two coaxial cylinders. The outer cylinder, or rotor, suspended in precision bearings, is driven at a constant rotational velocity and the torque arising from the fluid's viscous drag is exerted on the inner cylinder, or bob. The torque is rapidly balanced by a helically wound spring and the deflection is read on a calibrated dial through an optical reticule.

In this viscometric method, flow data are best analyzed in terms of the fundamental relationship between shear rate, proportional to rotor rpm, and shearing stress, proportional to dial reading.



Fig. 11. Fann V-G Viscometer

Ferranti Portable Viscometer
Ferranti Electric, Inc.
30 Rockefeller Plaza
New York 20, New York
Type: Rotational—rotating cup
(Couette coaxial cylinder)
Units: Poises
Viscosity Range: 0 to 200,000 Poises (Model VH)
Description: This viscometer consists of a rotating outer cylinder driven by a small motor with a second cylinder located coaxially within it. The inner cylinder is free to rotate against a calibrated spring with a pointer to show the angular deflection. The mechanism for driving and measuring is encased at the top of the instrument with a glass window for viewing the dial.

The inner cylinder is suspended in jewelled bearings and the outer cylinder is driven at constant speed by a specially designed synchronous motor of high torque. The resulting rotation of the liquid exerts a viscous drag on the inner cylinder causing a deflection proportional to the viscosity.



Fig. 12. Ferranti Portable Viscometer

Ferranti-Shirley Cone and Plate Viscometer
Ferranti Electric, Inc.
30 Rockefeller Plaza
New York 20, New York
Type: Rotational—cone and Plate
Units: Poises
Viscosity Range: O to 31,500 Poises
Description: This viscometer consists of a stationary flat plate and a slightly conical rotating disc driven by a variable speed motor. Infinitely variable rate of shear over a very wide range is provided by electronic control of the motor speed. When the sample fluid is sheared in the narrow symmetrical gap between the cone and the plate, the viscous traction on the cone exerts a torque on a precision electro-mechanical torque dynamo meter. This is communicated to an electrical measuring instrument giving clear readings on a finely divided scale having an actual length of 5 inches and an effective length of 25 inches.

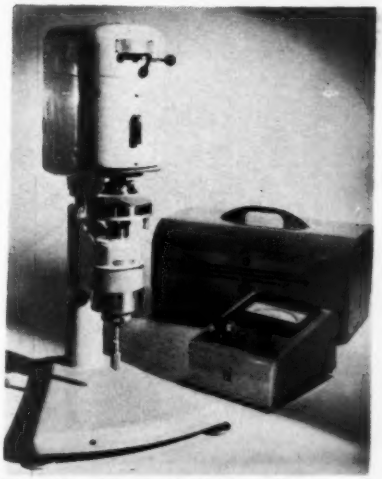


Fig. 13. Ferranti-Shirley Cone and Plate Viscometer

Thermocouples embedded in the plate (in direct contact with the fluid) enable temperature measurements to be obtained.
Reference: McKennel, R., Anal. Chem., *28*, 1710 (1956)

Gardner Bubble Viscometers
Gardner Laboratory, Inc.
P.O. Box 5728
Bethesda 14, Md.
Type: Air Bubble
Units: Stokes (Poises/Density)
Viscosity Range: 0.50 to 148 Stokes
Description: The viscosity of a sample of varnish or other transparent liquid is determined by matching the vertical speed of a trapped air bubble with that of the nearest corresponding tube. For this purpose two carefully calibrated empty tubes marked (MT) are furnished with each set. The (MT) tube is filled to the lower etched line with the sample under test. A cork is inserted as far as the upper etched line, thereby trapping an air bubble of standard length. The tube and the standards are then brought to a temperature of 25°C.

The time required for the bubble to rise in the liquid is directly proportional to the kinematic viscosity of the liquid and also is partially dependent upon the sp. gr. of the liquid.

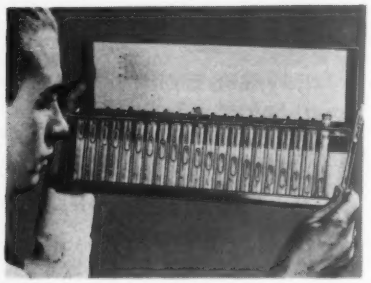


Fig. 14. Gardner Bubble Viscometers

Gardner No. 4 Ford Type Viscosity Cup
Gardner Laboratory, Inc.
P.O. Box 5278
Bethesda 14, Md.
Type: Efflux
Units: Seconds or Stokes (Poise/density)
Viscosity Range: 12 to 200 seconds or 0.12 to 7.54 Stokes
Description: This viscometer is a machined aluminum cup. Fitted into the conical bottom of the cup is a special type standardized brass orifice. The viscosity cup is placed in the cup stand and the orifice is closed with the finger. The material to be tested is poured into the cup. Excess material is scraped flush into the overflow trough. The time it takes the stream of material to flow out of the orifice is the measure of viscosity.
Reference: Anon. (Chicago Prod. Club), Off. Dig., *298*, 831 (1949)



Fig. 15. Gardner No. 4. Ford Type Viscosity Cup

Gardner Vertical Viscometer
Gardner Laboratory, Inc.
P.O. Box 5278
Bethesda 14, Md.
Type: Air Bubble
Units: Stokes (Poise/Density)
Viscosity Range: 4 to 5000 Stokes

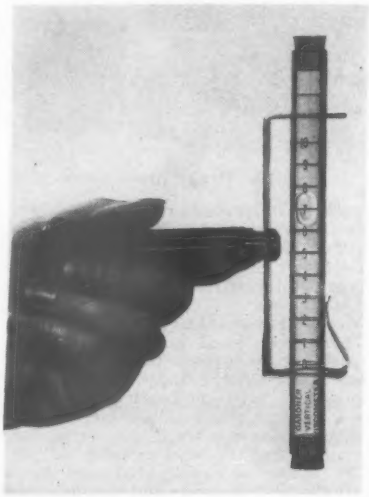


Fig. 16. Gardner Vertical Viscometer

Description: This viscometer is composed of a precision bore Pyrex glass tube approximately 155 mm. long and stoppered at both ends; a tube holder having clips to hold the tube on a small metal frame used to invert the tube by means of a rack and pinion arrangements; a large metal frame equipped with a true-vertical tube arrest and a heavy base plate unit fitted with levelling devices.

The time required for a bubble to rise in a liquid is directly proportional to the kinematic viscosity of the liquid. The size of the tube and the distance the bubble travel have been chosen so that the time in seconds is approximately equal to the viscosity in stokes.

Gardner Mobilometer
Gardner Laboratory, Inc.
P.O. Box 5278
Bethesda 14, Md.
Type: Perforated Plunger
Units: Poises

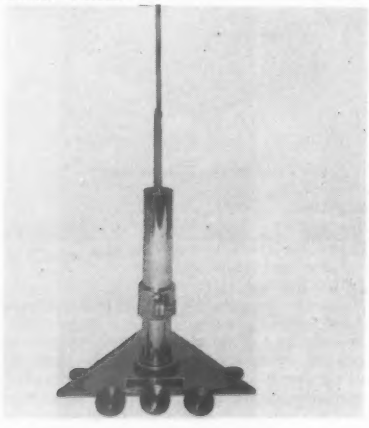


Fig. 17. Gardner Mobilometer

Description: The mobilometer consists of a metal cylinder, supported by a base which also supports a bracket holding a sleeve to guide the plunger. The plunger consists of a perforated disk mounted on the lower end of a shaft. A removable weight pan is mounted on top end of the shaft so that weights may be applied. The sample is placed in the cylinder; then the plunger is placed in position and allowed to fall through the liquid. Time for fall through a definite distance is measured. The rates of fall (reciprocal of time of fall) of the plunger are determined at several different weights by adding extra weights to the pan so that a force rate of flow graph may be drawn.

G.E.-Zahn Viscometer
Gardner Laboratory, Inc.
P.O. Box 5278
Bethesda 14, Md.
Type: Efflux
Units: Zahn Seconds
Viscosity Range: 0.2 to 12 Poises (Depending on cup)
Description: The G.E.-Zahn viscometer consists of a bullet-shaped stainless steel cup. It is suspended into the liquid by a 12-inch looped handle. A small ring at the top of the handle allows the operator to hold the cup in a vertical position when withdrawing it from the liquid for a reading. The viscometer is usually left in the liquid between readings so that it can assume the same temperature as the liquid that is to be measured.



Fig. 18. GE-Zahn Viscometer

Hagan Viscometer
Hagan Corporation
323 Fourth Avenue
Pittsburgh 30, Pa.
Type: Rotational—Rotating Bob
Units: Poises
Viscosity Range: 0.1 to 20 Poises
Description: The basic principle of the torque measuring device involves measuring a force by automatically supplying a counterbalancing force established by pneumatic pressure imposed upon a known area. The measurement of the pneumatic pressure then becomes an accurate measure of the torque developed by viscous drag.

The torque measuring device is supplied with air under constant pressure and is mechanically coupled to the sample cup of the viscometer. The output pressure (balancing force) of the torque measuring device is linearly proportional to the torque (applied force) developed on the sample cup due to the viscous drag of the test material. This output air pressure is recorded by a Hagan instrument which

simultaneously records the rate of shear by rotating the chart a distance proportional to the rate of bob speed.

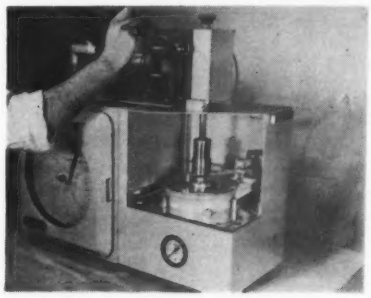


Fig. 19. Hagan Viscometer

Hercules Hi-Shear Viscometer
Gardner Laboratory, Inc.
P.O. Box 5728
Bethesda 14, Md.
Type: Rotational—Rotating Bob
Units: Poises
Viscosity Range: 0.2 to 90 Poises
Description: The Hercules Hi-Shear Viscometer consists of rotating bob, which is rotated by power transmitted from a variable speed drive. The cup, which holds the sample, is locked into a receiver, which is connected by a string wrapped around the receiver to two springs and a pen.

The bob is lowered into the sample in the cup, and the resulting viscous drag on the cup is automatically registered by the pen on graph paper wrapped around a recording drum, which revolves synchronously with the variable speed drive. The resulting rheogram drawn by the pen indicates viscosity and the type of flow.
Reference: Smith, J. W. and Applegate, P. D., Paper Trade Journal, *126*, 266 (1948)



Fig. 20. Hercules Hi-Shear Viscometer

MacMichael Viscometer
Fisher Scientific Company
Greenwich & Morton Street
New York 14, N. Y.
Type: Rotational—rotating cup
Units: Arbitrary degrees M (1/300 circle) which can be converted to poises
Viscosity Range: 0 to 2600 Poises
Description: The MacMichael Viscometer operates on the torsion principle. A plunger of standard dimensions is suspended by a torsion wire of fixed length from the top of the instrument. The material is placed in a cup, which is revolved at a constant speed on a motor driven platform mounted on ball bearings near the center of the instrument. The amount of twist imparted to the wire, depending upon the viscosity of the material, is read on a graduated disk attached to the spindle.

The cup which holds the sample is placed within an outer cup which serves as a water or oil bath for heating the material, if desired.



Fig. 21. MacMichael Viscometer

Ostwald-Cannon-Fenske
Arthur H. Thomas Company
Vine Street at Third
Philadelphia 5, Pa.
Type: Capillary
Units: Poises
Description: This viscosity is based on the Poiseuille formula which states that the volume per second of liquid flowing through a capillary is directly proportional to the activating stress.

The liquid to be tested is drawn into the enlarged bulb above the upper mark and is then allowed to flow through the capillary. The time the liquid takes to pass between the 2 marks is measured. This value is compared to that of water or other standard liquid in the same capillary and absolute viscosity is determined.

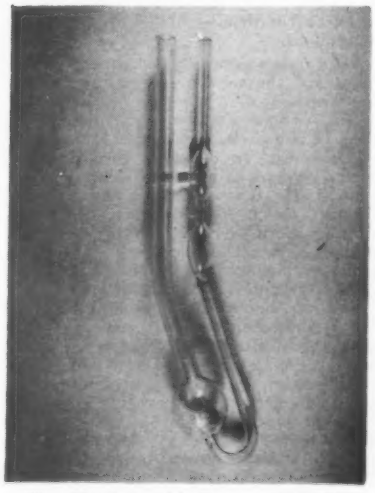


Fig. 22. Ostwald-Cannon-Fenske

"Precision"—Interchemical Rotational Viscometer
Precision Scientific Co.
3737 W. Cortland Street
Chicago 47, Illinois
Type: Rotational—rotating cup
Units: Poises
Viscosity Range: 1 to 2500 Poises
Description: The viscometer consists essentially of a cup which contains the sample, mounted in a variable speed rotor. A cylindrical bob supported by a coiled torsion spring is immersed in the cup. As the cup is rotated, the viscous drag of the material twists the spring through an angle measured on a graduated disk.

The cup is enclosed in an insulated water bath with temperature controlled to 0.05°C.

The speed of rotation of the cup is controlled by a Thy-Mo-Trol electronic speed regulator coupled to a ¼ H.P. motor.
Reference: Bloomquist, C. R., Tyler, J. E. and Grey, C. E., Interchemical Review, *7*, 16, Spring 1948

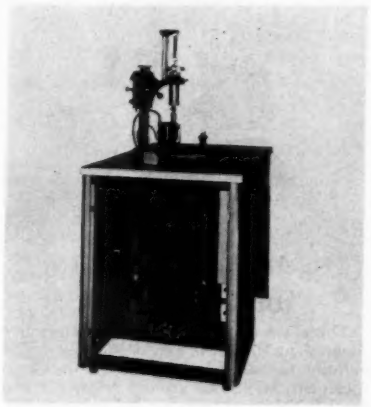


Fig. 23. "Precision"-Interchemical Rotational Viscometer

Saybolt Viscometer
American Instrument Co., Inc.
8030 Georgia Avenue
Silver Spring, Md.
Type: Efflux
Units: Seconds or Centistokes
Description: The Saybolt viscometer consists of a gasketed vessel with an overflow gallery at the top and an efflux tube on the bottom for discharge. The vessel contains about 60 ml. and the viscosity is determined by timing the flow of 60 ml. under gravity.



Fig. 24. Saybolt Viscometer

Stormer Viscometer
Arthur H. Thomas Co.
Vine Street at Third
Philadelphia 5, Pa.
Type: Rotational—rotating paddle or bob
Units: Krebs Units
Description: The Stormer viscometer determines the viscosity by measuring the

time required for a definite number of revolutions of a rotating paddle, bob or other type of rotor—immersed in the sample placed in the test cup and driven by a falling weight through a series of gears. A revolution counter is attached to the spindle of the rotating paddle or other rotor.

Reading exact speed of 200 rpm can be facilitated by using a Stroboscopic attachment (National Lead Company Timer) Reference: Geddes, J. A., and Dawson, D. H., I&EC, *34*, No. 2,143, (1942)



Fig. 25. Stormer Viscometer

Other Viscometers

There are a number of viscometers not covered in this directory. Many are not manufactured and have to be built to specification. Some are not related to the coating field, others are. However, many of the viscometers described in literature are of great interest in the study of viscometry.

Many of these are built around modifications of the Stormer Viscometer. Fisher (6) describes a modification covering a range of 0 to 150 poises which consists of a cup, bob and water bath. Asbeck, et al (1) relates paint brushability to viscosity measurements made by a modified Stormer: a high shear self-centering rotational viscometer.

The falling ball viscometers consist of a glass tube in which liquid is placed and a spherical object, heavier in gravity than the liquid and considerably smaller than the diameter of the tube. The glass tube is etched with two or more marks so that the rate at which the sphere falls through the liquid column may be measured. In the Hoeppler viscometer, a sphere is allowed to roll down the inside of a cylindrical containing vessel that is inclined from the vertical.

The Fisher Electroviscometer is designed to measure viscosity directly in absolute units. It is a torsion viscometer of the Couette type. However, the rotor and spindle are not allowed to turn under the influence of the viscous drag of the paint, but are restrained by an opposing electromagnetic force. This is done by attaching the spindle to a coil placed between the poles of a magnet and by adjusting a current flowing through the coil until the restoring torque just balances the torque produced by the viscous drag of the paint. The current necessary to balance the two torques is measured on an ammeter whose scale is calibrated in centipoises.

The band viscometer suggested by Wachholz and Asbeck (19) was designed in accordance with Newton's model of flow (Fig. 2). It consists of an endless band which moves for a portion of its length in the center between two parallel stationary plates with the test material between the plates and the band.

Humphreys and Stone (12) describe the measurement of high viscosities by shearing thin films between two parallel stainless steel plates. In this way frictional heat is rapidly dissipated, temperature being registered by a thermistor.

Mell (13) discusses a recording coneplate viscometer which automatically plots of shear against shearing stress at two shearing-rate ranges, 0 to 15 sec.$^{-1}$ and 0 to 300 sec.$^{-1}$. The torque is measured by unsupported wire strain gauges; torques of the order of one gram centimeter can be measured and recorded with only an infinitesimal movement of the cone.

The Roger and Heyd viscometer is a falling object type. Pressure and temperature are controlled and the falling plummet is equipped with radioactive cobalt (Co^{60}). Fall time or viscosity is measured by means of four Geiger-Muller tubes arranged for coincidence counting (18).

A vibrating plate viscometer has been patented by Woodward (23) and assigned to RCA. The apparatus is electromagnetic in nature and operates somewhat as an electric doorbell. Attached to the end of the vibrating member is a thin circular plate arranged so as to move the test liquid back and forth in a direction parallel to its own. Vibration of the plate sets up waves in the test medium which consume energy; this reduces the frequency of the vibrator unless additional energy is supplied. A piezoelectric crystal pickup around the vibrator provides a means to maintain constant frequency so that viscosity can be measured in terms of energy consumed (18).

Continuous Recording Viscometers

Automatic continuous viscosity recording and control instruments are helping to bring automation to paint and allied industries. The feedback concept is the basic underlying principle of this technology. Feedback control makes a process follow a given pattern, the results of which are usually, but not necessarily recorded. The actual instantaneous performance is sent back to the controls which are either built into the viscometer or within the recorder and which, in either case, automatically make the required corrections.

Continuous recording instruments in the plant are the best means of controlling the viscosity of a substance being processed. There are numerous problems, chief of which is the necessity for some compensation to allow for the large viscosity changes which arise from fluctuations in the temperature of the product; it may also be necessary to correct for changes in ambient temperature. Special manufacturing conditions, e.g., high temperature, low or high pressure, may require continuous sampling through a bypass line. Safety needs may forbid electrical equipment. The nature of the product is often troublesome, e.g., the viscosity of an effervesing fluid is virtually meaningless. For non-Newtonian liquids it may be necessary to measure at several different shear rates, and it is difficult to correlate the properties of the final product with the behavior of the viscosity under manufacturing conditions (4).

A factor of considerable influence in measuring viscosity is its dependence on temperature. A change in 1°F. may produce as much as 10 percent change in viscosity. Temperature compensators are available, but they require a linear relationship between viscosity and temperature. As a general rule, it can be stated that the temperature should be kept constant, if necessary by controlled heating or cooling. Temperature compensation in the viscosity instrument should be used to correct for remaining minute temperature deviations (11)

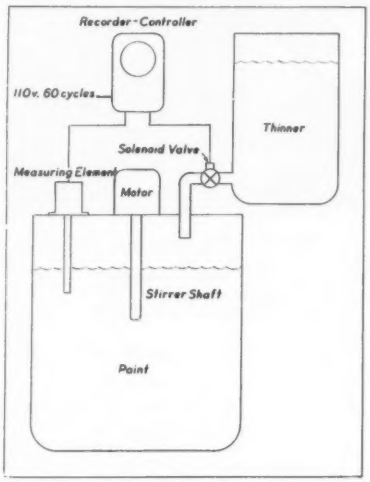


Fig. 26. Schematic for controlling viscosity of paint.

Figure 26 illustrates a general scheme for controlling the viscosity of a paint with a continuous recording and controlling viscometer. The measuring element of the continuous viscometer controls the addition of the thinner to adjust the viscosity of the paint by means of a solenoid valve which in turn is controlled by the recorder-controller.

Some of the principles of the mechanism of continuous recording viscometers can be illustrated by the following viscometers:

1. The Fischer-Porter Flow Tube Viscorator measures shear at fired pressure and flow through a calibrated tube containing flow and viscosity sensitive floats (22).
2. The Norcross Viscometer is based on timing a falling plummet through a liquid.
3. The Rich-Roth Ultra-Viscoson is based on the rate of vibration of super-sonic waves passed from one segment to another segment of a probe immersed in a liquid.
4. The Brookfield Viscometran measures torque produced by a cylinder which rotates at a constant speed in the liquid under test. The torque required to produce this rotation is directly proportional to the viscosity of the fluid.

Fischer-Porter Viscolator

The Fischer-Porter Viscolator records viscosity continuously by forcing a liquid, at constant flow and temperature, upward through a vertical, conically tapered, graduated, glass tube containing two floats. The bottom float is sensitive to flow and is used to keep the flow rate constant, while the top float is sensitive only to viscosity. As the viscosity of the fluid increases it forces the viscosity sensitive float gradually upward along the graduations of the glass tube from which readings are taken (22).

The Viscolator is installed in a by-pass to a main flow line. A throttling valve or orifice in the main line creates a pressure differential which insures a reasonable flow through the instrument. To obtain a reading, manual adjustment to the flow-rate index-setting valve is required. By manipulating this valve, the flow through

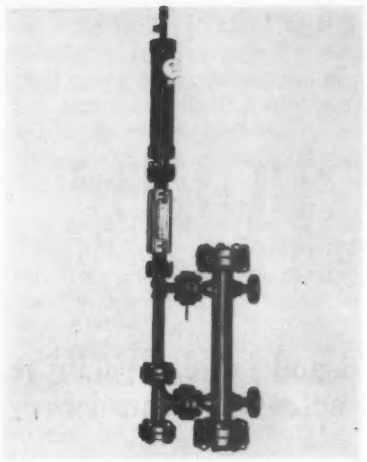


Fig. 27. Fischer-Porter Viscolator

the by-pass is adjusted until the upper float is opposite the index flow-setting graduation on the capacity scale. Viscosity is then read by noting the position of the lower float with respect to the viscosity graduations on the lower part of the scale (11).

A receiving unit (Fig. 28) contains the viscosity receiver and amplifier, the temperature compensating mechanism. Both process fluid temperature and temperature-compensated viscosity are recorded and indicated on a plastic scale. Temperature-compensated viscosity values can be pneumatically transmitted to a remote instrument or, where applicable, a pneumatic controller can be incorporated.



Fig. 28. Receiving unit

Norcross Viscosimeter

The Norcross Viscosimeter is designed to determine viscosity by measuring the time it requires a plummet to fall through a tube of material to be tested. A piston assembly is periodically raised by an air or electric motor-operated lifting mechanism, drawing a sample into the measuring tube. The sample goes on down through the clearance between the position and the inside of the tube, into the space which is formed below the piston as it is raised. The assembly is then allowed to fall by gravity, expelling the sample out through the same path as it entered. The time of fall is a measure of viscosity, with the clearance between the piston and the inside of the tube forming the measuring orifice.

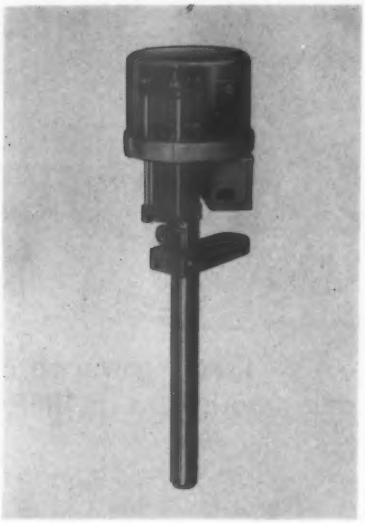


Fig. 29. Norcross Viscometer.

As long as the piston is falling by its own gravity an electrical contact is closed. The contact is in a circuit that energizes an electric motor in the recorder. The motor movement is linked in the pen. When the piston reaches its lowest point, the motor stops and the pen returns to zero. Since the piston goes through its cycle usually once every three minutes, the pen will be deflected from its zero position at equal intervals. The maximum positions of the pen indicate the viscosity of the liquid. The contour of those maximum positions on the chart shows the change in viscosity (11).

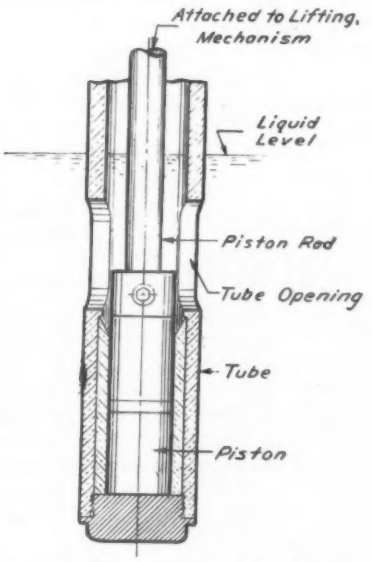


Fig. 30. Schematic of Norcross Viscosimeter

Rich-Roth Ultra-Viscoson

The Rich-Roth Ultra-Viscoson is a continuous ultrasonic viscometer in which the viscosity of a fluid is measured by its damping effect on a probe of magnetostrictive alloy which vibrates longitudinally at ultrasonic frequency. The vibration is initiated by a short pulse in the probe coil, which also tracks the decay of amplitude of the vibrations. The rate of oscillation is approximately 28 kc. When the amplitude reaches 1/500 of the initial value, the central circuit supplies a reinforcing pulse. The frequency of the reinforcing pulses is translated into viscosity by the central circuit. Output is fed to a recorder or process unit. When the blade is inserted in the sample, the rapid longitudinal movement makes the adjacent layers of the sample material slip back and forth over one another in a



Fig. 31. Rich-Roth Ultra-Viscoson

shearing type of motion. The rate at which the oscillations of the blade are damped or "die out" depends upon the viscosity of the sample. The relationship between damping and fluid viscosity is solved continuously and automatically by the computer and presented on an indicating meter calibrated directly in centipoises—grams per cc. There are 4 ranges giving readings of 0 to 500 poise density. Adjustments for calibrations are made with standard fluids.

Brookfield Viscometran

The Brookfield Viscometran measures torque produced by a cylinder which is rotated at constant speed in the liquid under test. The torque required to produce this rotation is directly proportional to the viscosity of the fluid. The Viscometran transmits a viscosity signal to a suitable receiver by sending an electrical impulse proportional to the torque required to rotate the spindle.

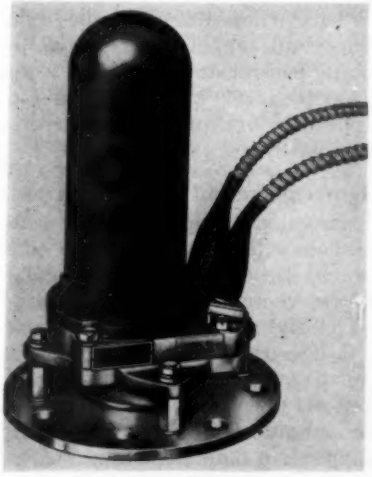


Fig. 32. Brookfield Viscometran

The Viscometran measures torque with a synchronous motor driving a cage at constant speed. The upper spindle arm is coupled to the cage through a beryllium copper spring. During measurement the spring is wound up until its force exactly equals the viscous drag on the spindle. Then the cage and the spindle both rotate at the same speed but with a definite angular relationship to each other proportional to the torque on the spring.

(Turn to page 168)

INSTRUMENTATION in VARNISH MANUFACTURE

Trend towards closed and large capacity reactors points up the need for automatic control

ONE area of paint manufacturing in which instrumentation has been successfully used is varnish and alkyd processing. The trend toward the use of closed kettles equipped with automatic temperature controllers and other auxiliary instrumentation has been adopted by many firms. Undoubtedly instrumentation has resulted in greater and more efficient production schedules, but of most importance, it has yielded better product uniformity.

This article fully describes two important applications of automatic control in varnish and resin processing: (1) kettle reaction and (2) end-point control in polymerization reactions.

Temperature and Combustion

Reaction temperature is controlled with a pneumatically operated Brown ElectroniK circular chart recording potentiometer (TRC) by means of a thermocouple (T) inserted into the bottom of the kettle. (See Figure 1). The output air pressure of the instrument is connected to three high lift diaphragm motor operated valves. One valve (A) is installed on the line supplying water to the cooling coils, while the other two valves, (B and C) are installed on separate combustion air lines connected to the manifold and single gas burners heating the kettle.

The arrangement provides a means of changing the heat supply capacity. As the batch is brought to cook temperatures both burners are in operation. As the control point is approached, the manifold burner is extinguished, leaving the single burner to bring the batch up to the control point. When the control point is reached, the single burner goes out, and the water valve opens, allowing cooling water to circulate through the coils.

The system is designed so that all burner valves are open when the instrument is delivering 15 psi air to the diaphragm motor control valves. As the temperature of the varnish rises, the instrument outlet air pressure drops, until at 10 psi an electrical contact in a pressure switch (P1) opens, breaking the circuit to the solenoid valve (S1) which feeds gas to the manifold burner, shutting off the gas flow to the burner. As the temperature continues to rise, the instrument outlet air pressure continues to fall, until at the control point the

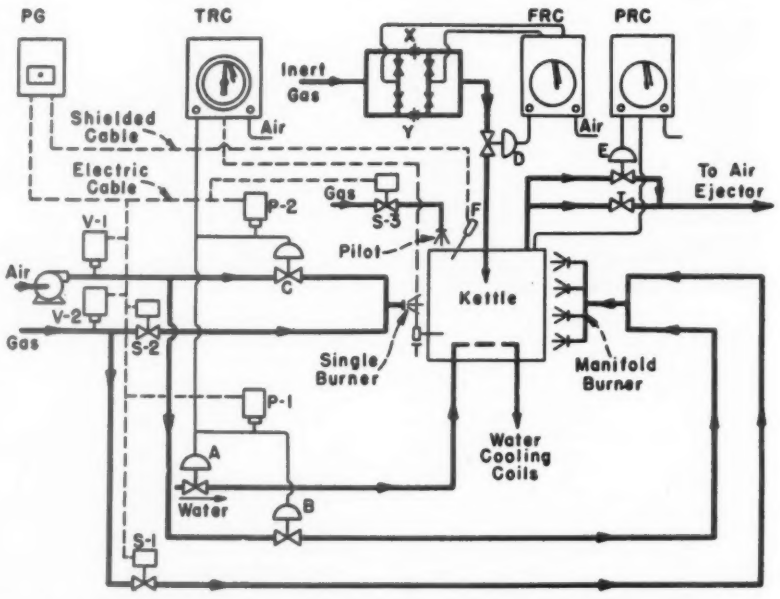


Figure 1. Schematic of kettle control system. Legend: Recording Temperature Controller (TRC); Recording Flow Controller (FRC); Recording Pressure Controller (PRC); Protectoglo Combustion Safeguard Relay (PG); Diaphragm Motor Control Valves (A,B,C,D,E); Flame Electrode (F); Pressuretol (P); Solenoid Gas Valves (S); Thermocouple (T); Vaporstat (V).

Prepared by editorial staff of PAINT AND VARNISH PRODUCTION.

pressure reaches a value of six psi. At that point the electrical contact in another pressure switch (P2) opens, extinguishing the single gas burner, while the cold water valve opens, proportionally controlling the flow of water through the cooling coils.

Combined with the use of direct firing, this method of control continuously maintains the temperature within plus or minus one degree.

In the event of failure of the gas flame, combustion air blower, gas pressure or electric or air power supply, a combustion control system automatically shuts off the gas.

A Protectoglo relay (PG) is electrically interlocked with pressure switches P1 and P2, so that when flame failure is detected by the flame electrode (F), the relay can de-energize the circuit to the three solenoid gas valves, causing them to close.

Similarly, if either the air blower or gas supply fails, other pressure switches (V1 and V2) cause the gas valve to close. The solenoid valves are the spring closing type, so that electric supply failure is not dangerous. Instrument air supply failure also results in a closing of the solenoids through pressure switches P1 and P2.

Froth Warning

A recent development by Negretti & Zambra Ltd. of London employs a temperature transmitter as a froth warning. (See Figure 2).

The sensitive portion of the transmitter is located slightly above the level of the varnish, and is set to a temperature a bit lower than that of the varnish. In the event of frothing, the small amount of heat transmitted by the froth is sufficient to operate the transmitter so that a warning can be given.

The high response to thermal change of the transmitter enables the froth warning device to operate successfully while the transmitter itself facilitates fine control setting. The receiving instrument may either be of the standard electric indicating type, or of a recording type, either of which may be arranged to indicate audible or visible warnings.

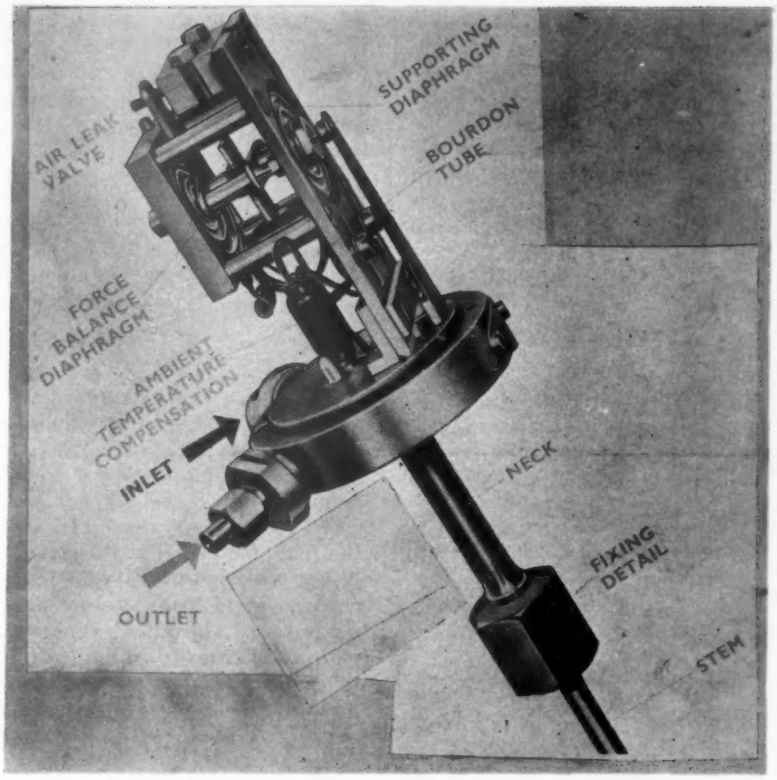


Figure 2. Working model of temperature transmitter.

Pressure and Vacuum Control

The reaction is usually carried out under atmospheric pressure conditions, in an inert atmosphere. On some occasions, depending upon the nature of the batch, a vacuum or pressure is applied to the vessel.

Pressure or vacuum control is obtained from a recording pressure gauge (range 30 inches of mercury vacuum to 15 psi gauge) with wide band proportional control. The controller positions a high lift diaphragm motor control (Figure 3) valve on a by-pass line to a venturi type air ejector. Pressures above atmospheric are obtained by throttling of the ejector exhaust against the pressure generated by the batch and the inert gases introduced into the kettle.

Volatile materials are condensed by means of a special trap, which prevents them from being carried over into the air ejector system.

Inert Gas Flow Control

The introduction of inert gases to the kettle during the reaction furthers the mixing process and provides a protective non-combustible blanket which covers the inflammable contents of the vessel. The inert gases consist of approximately 13 per cent carbon dioxide and 87 per cent nitrogen.

The generating equipment manufactured by C. M. Kemp Mfg. Co. consists fundamentally of a gas combustion system in which fuel gas and air are proportioned for complete combustion. The generator supplies inert gases at a controlled rate in accordance with predetermined schedules.

The controlled rate of inert gas flow depends upon the nature of the batch being processed, and varies from one to 50 pounds per hour. A method of obtaining greater accuracy in metering and controlling the gas flow utilizes a double orifice piping arrangement which has been devised for use with a conventional Brown mechanical flow recorder equipped with wide band proportional control. The final control element is a high lift diaphragm motor valve (Figure 3) mounted in a half-inch gas line to the kettle.

In the operation of the double orifice arrangement (see Figure 1) one orifice (X) is sized for a maximum flow of five pounds per hour, while the second orifice (Y) is sized

for a maximum flow of 50 pounds per hour. For flows greater than five pounds per hour, the block valves to X are closed and the lower two valves are opened, routing the flow through Y.

In calculating the actual flow of gas, the operator multiplies his chart reading by 0.01 when orifice X is in use, and by 0.1 when orifice Y is open. The chart range is 0 to 500.

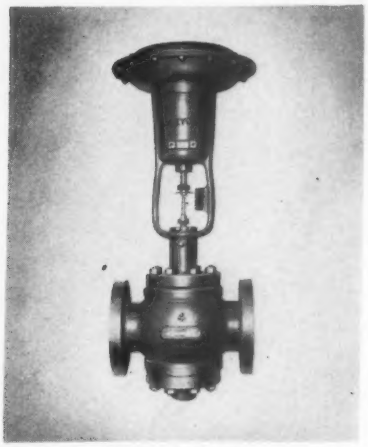


Figure 3. High lift diaphragm motor control valve.

Automatic Filtering

The problem of filter frame clogging in the use of filter-presses for clarifying varnish and vehicles has been surmounted through the development of a rotary pump unit by Foster Pump Works, Inc.

In normal operations the frames gradually become clogged as the filter-press removes foreign matter from the varnish. If the initial amount of varnish was continuously passed through the filter-press as it clogged, the press would become overloaded and either the frames would break or the varnish would be improperly filtered. Customary procedure as the varnish is being pumped from the supply tank is to manually by-pass varied amounts of the varnish back into the supply tank to prevent the press from overloading. The process necessitates the pumping of two gallons for every gallon filtered.

The automatic filter press pump (Figure 4) developed by Foster has demonstrated four features. It automatically watches the pressure build up in the press, it automatically varies the capacity of the varnish being pumped to the exact maximum that the press can handle, it automatically cuts down the capacity of the varnish being pumped as the filter-press becomes clogged, and it ceases operation automatically when the filter-press is no longer able to filter the varnish.

The automatic equipment dispenses with human attendance during the filtering phase of varnish production, and insures but one passage through the pump of all of the varnish prior to filtration.

Viscosity Changes

During the past few years some progress has been noted in the application of instrumentation for recording changes in viscosity. Continuous recording viscometers have found use in two basic applications. One application is concerned with the manufacture of varnishes and resin, and involves recording changes in viscosity during polymerization. The other is concerned with automatically adding solvent to maintain a constant viscosity for processes where the coating materials are applied to various products.

This discussion will deal exclusively with the first application.

Viscosity, according to Doolittle, is defined as the resistance that a fluid offers to continuous deformation. A more simple definition of viscosity is that property of a fluid that resists flow at any velocity, however small.

A true mobile liquid such as water or mineral oil, exhibiting the simplest possible type of flow, is known as a Newtonian liquid. If such a liquid is placed between two parallel plates and the top plate is moved at a constant velocity, each layer of molecules moves with a velocity directly proportional to its distance from the stationary plate. Mathematically, viscosity equals the shear stress divided by the rate of sheer and is termed absolute viscosity expressed in poises.

An established fact in polymer technology is that a change in viscosity indicates a fundamental change in the degree of polymerization of a resin. Since a polymer with a large molecular weight becomes less soluble and immobile, it follows that its shear stress will be greater resulting in an increase in viscosity.

In the manufacture of alkyd resins, the tendency amongst most producers is to employ large capacity reactors. With large capacity reactors, it became necessary to trace the size of the polymer particle as accurately and continuously as possible during the polymerization process. One means of obtaining a desired end point in polymer formation is by stopping the reaction at a certain viscosity range.

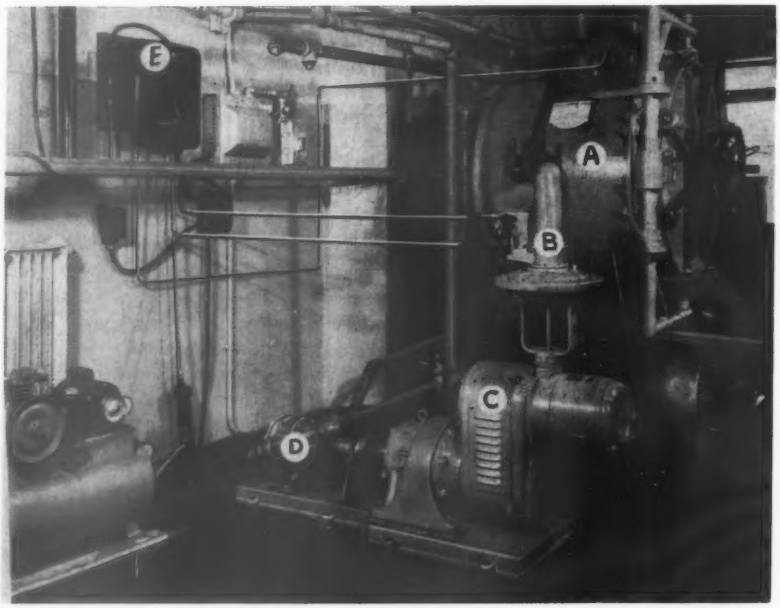


Figure 4. Filtering varnishes with automatic filter press pump: A-Filter Press, B-Pressure Regulator, C-Vari-Drive Gearmotor, D-Foster Rotary Pump, E-Pressure Control.

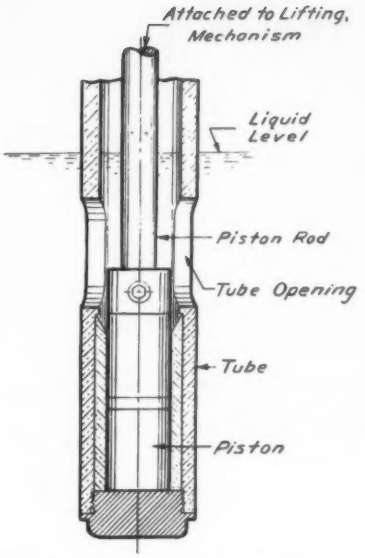


Figure 5. Schematic of Norcross Viscometer.

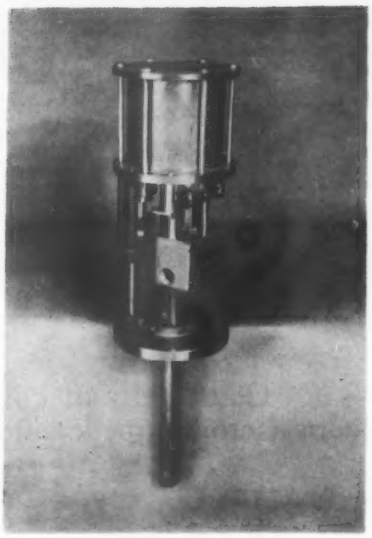


Figure 6. Measuring Element.

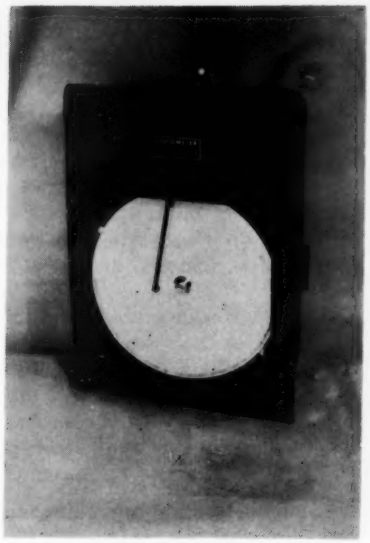


Figure 7. Recorder.

To accomplish this, two viscosity measuring instruments have been successful in alkyd manufacture.

Norcross Viscometer

This unit consists of an electric pneumatic viscometer measuring elements for use with recorder and controllers.

A piston assembly shown in Figure 5 is periodically raised by an air lifting mechanism drawing a sample of the liquid to be measured in through the tube openings. The liquid then goes down through the clearance between the piston and the inside of the tube into the space which is formed below the piston as it is raised. The assembly is then allowed to fall by gravity, expelling the sample. Time required for the piston to drop is a measure of viscosity, and this measurement is electrically transmitted to an associated round chart recorder. Figure 6 is a photograph of the Model M1O measuring element and Figure 7 the R3 series recorder.

Figure 8 is an actual chart taken from this viscometer showing the viscosity build-up during a polymerization process. Each time viscosity is measured, the pen makes one stroke on recorder, strokes becoming longer as viscosity increases.

In an actual installation at the Armstrong Paint & Varnish Works, Chicago, Ill., this recording viscometer has resulted in savings of about $5,000 per year. Previous methods for measuring viscosity were too slow for proper control of the process. Some 10-20 minutes were required to take a sample from the kettle by hand, thin it to the proper solids content, cool it, and make a viscosity comparison with Gardner-Holdt standards. Sometimes the viscosity of the batch would increase more rapidly than expected, resulting in a gel. This would tie-up a kettle for two days, delaying production and upsetting delivery schedules.

With this recording viscometer, the company claims at least three gels per year have been prevented, saving them $5,000. In another instance, Armstrong was able to quickly detect the abnormal performance of a batch of varnish which was too low in viscosity due to insufficient blowing of carbon dioxide. Other advantages of this instrument are improved product uniformity and closer control of viscosity, particularly when the same formulation is used for several batches. Viscosity measurements do not drift from batch to batch.

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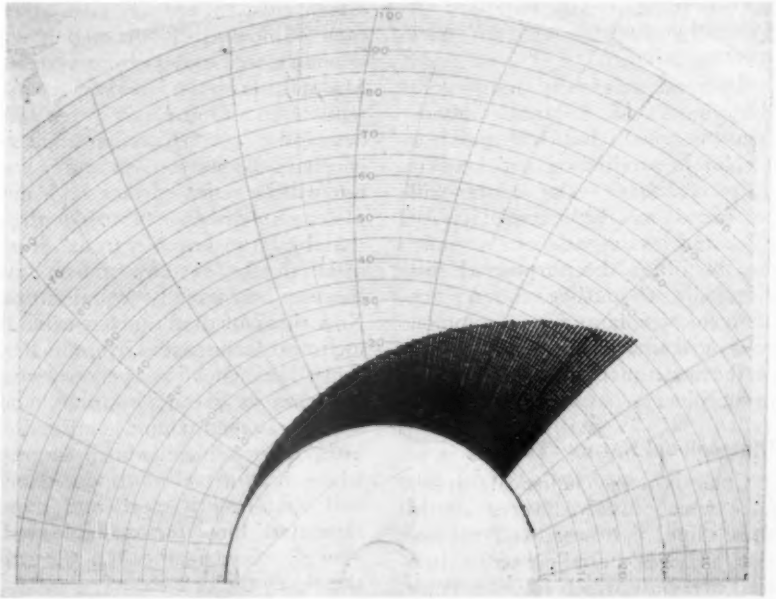


Figure 8. Actual chart taken from Norcross Viscometer on a reactor application showing the viscosity build-up during a polymerization process.

COLOR MEASUREMENT and CONTROL

Complexity of color and its dependence on many factors impede automation in color control

By O. H. Olson*

AUTOMATION is the goal of every production engineer. Remove the human element in quality control, reduce labor costs, turn out a more uniform product, are the commandments of his job. The electric eye and the electron tube have become the slaves of modern man from the opening of supermarket doors to complicated sorting operations in the manufacturing plant. Missiles are guided to their targets by optical electronic systems, complex calculations are performed in phenominally short times by electronic computers, hundreds of production controls are performed automatically.

With all this, why not color? Why hasn't an electronic device been designed that will monitor a color in production and keep it up to standard? The answer will be found in the complexity of color and its dependence on many factors. It is the purpose of this discussion to outline the science of color, explain some common color systems and describe some of the instruments used for measuring color.

Dimensional Nature of Color

Color is a psychological experience which involves three attributes: hue, lightness, and saturation. Hue is a familiar term; it is that attribute which classifies color according to similarity to a spectral color such as red, green, blue, etc. The other attributes are less familiar and more difficult to grasp. Lightness describes the over all luminous effect of a color. Thus, pink is high in the lightness scale whereas maroon is low but both have the same hue. Saturation is the concentration or the departure of a color from neutral gray. Olive drab and old rose are desaturated colors whereas fire engine red and lemon yellow are saturated.

Thus, a complete psychological description of color involves three dimensions. The significance of each is more easily grasped if we refer to a well known color system. Munsell, an artist, devised a system, often called a color tree. A description of this system appears in many books on art and color but will be repeated here for completeness. Imagine a tree with a variable gray trunk varying from black at the bottom to white at the top in visually equal steps. Now think of the branches extending towards the east as red branches, south branches as yellow west branches as green and blue, and north branches as purple. Finally, imagine any single branch as gray where it is attached to the trunk and acquiring a more and more saturated hue, for example red, as we proceed farther out towards the tip of the branch.

Munsell called the three dimensions, "hue", "value" (lightness), and "chroma" (saturation). In his system pink lies on a high branch and maroon on a low one; old rose is near the trunk and fire engine red close to the tip of a branch. All are on branches pointing towards the east because all have a red hue.

Ingredients of Color

The color of an object depends on the spectral distribution of the light which enters the eye from the object in question. By spectral distribution of light is meant the relative amounts of light energy at each wave length. The eye is sensitive to wavelengths from about 400 to 700 millimicrons so only this range is of interest in our discussion. There are two factors which determine the spectral distribution of light reflected from a colored object: one is the spectral distribution of the source of illumination, the other is the spectral reflectance of the object itself.

Figure 1 shows how much light energy is emitted at each wavelength by a number of common sources. The colors corresponding to different wavelengths have been placed by the chart for convenience. It will be seen that an incandescent source or ordinary light bulb emits much more energy in the yellow and red region than in the violet and blue. Average daylight, although it favors the blue, tends to be more equal at all wavelengths. It is interesting to note that the light from a

*Armour Research Foundation, Illinois Institute of Technology, Chicago, Ill.

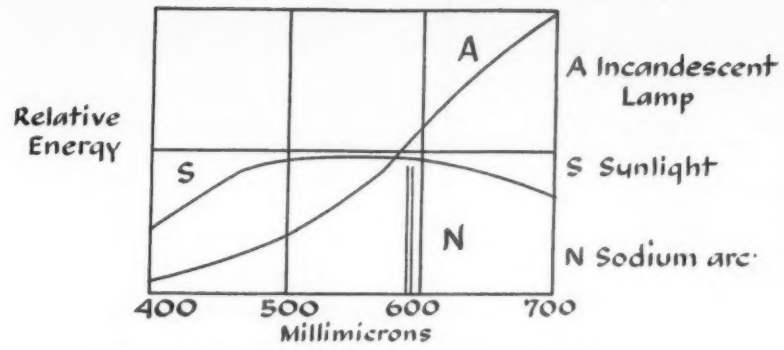


Figure 1. Spectral Energy Curves of Some Light Sources.

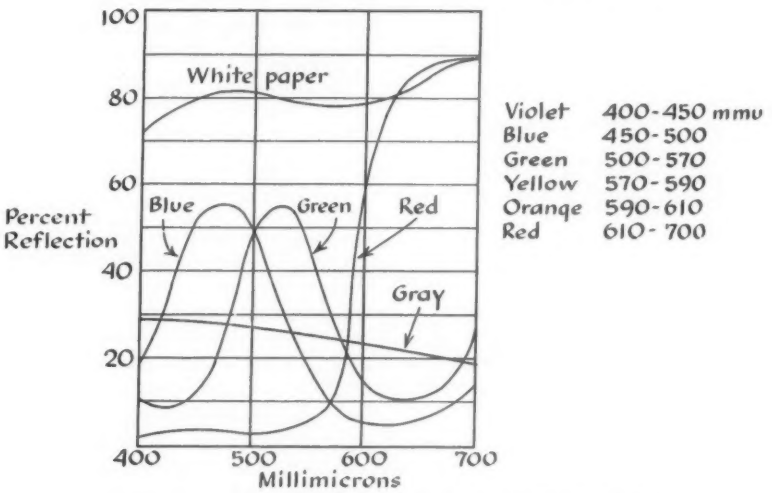


Figure 2. Spectral Reflectance Curves of Various Colors.

sodium arc lamp is confined to one wavelength, more about this later.

Figure 2 shows how different colors reflect light. It is seen that some light is reflected at all wavelengths by all colors but that each color has a range of wavelengths at which it reflects more than at others Only neutral grays and white reflect rather uniformly throughout the whole spectrum. To find the spectral distribution of the light reaching the eye of an observer from a colored sample we must take the percentage reflected at each wavelength shown in Figure 2 and multiply it by the energy of the source at the corresponding wavelengths. Obviously, this product curve will change if either the source distribution or the reflectance curve changes. This explains why the color of an object depends both on the source of light and on the reflecting properties of the object. An extreme example is the case of illumination by sodium light (Figure 1). A material which has high reflectance in the long wavelength region will appear yellow but one whose reflectance is low in this region will appear gray and dull. It can assume no other color than yellow or gray because the source emits only yellow. The color observed is also a function of the color sensitivity of the eye because all people do not see colors alike.

An objective system of color specification is based on the facts discussed above. It rests on the adoption of three standard sources of illumination by international agreement. They are called simply Sources A, B, and C and correspond approximately to an incandescent source, noon sunlight and average daylight, respectively. Their spectral distributions are given by curves like those in Figure 1. An average or standard observer is represented by a set of three response curves, also adopted by international agreement. Reflectance curves like those in Figure 2 are combined with the desired source curve and eye response curves by a mathematical calculation which gives the specification of a color in terms of three tristimulus values. Recall that color is three dimensiona.l These are called X, Y, Z. Further reduction yields the x and y coordinares of a color so that it can be plotted on a diagram as in Figure 3.

Human judgment is not involved in this specification so it is entirely objective. It is known as the ICI or CIE system (International Commission of Illumination or Commission International de l'Eclairage).

Instruments of Color Measurement

Color measuring instruments fall into three classifications based on what they measure:

1. Spectrophotometers
2. Tristimulus Colorimeters
3. Abridged Spectrophotometers

Spectrophotometers

A spectrophotometer is an instrument capable of producing the reflectance curves of Figure 2. It is equipped with either a prism or diffraction grating which disperses the light from a filament lamp into a spectrum. Slits isolate a narrow band of wavelengths so that reflectances can be measured for monochromatic light—light of one color. The instrument compares the reflection from the sample with that from a magnesium oxide standard surface which is taken as 100%. Important features of a true spectrophotometer are its ability to isolate narrow wavelength bands and its accuracy.

The most widely used instrument in this class is the General Electric Recording Spectrophotometer. It is shown in Figure 4. and its operation is described by means of the schematic diagram of Figure 5. An automatic tristimulus integrator is available as an accessory. With it the tristimulus values are calculated concurrently with the drawing of the color curve so that the values may be read from three dials as soon as the curve is completed.

Of special interest is the Rapid Scanning Spectrophotometer of the American Optical Company which is unique in that the color curve is presented on the screen of a cathode ray tube. Since the de-

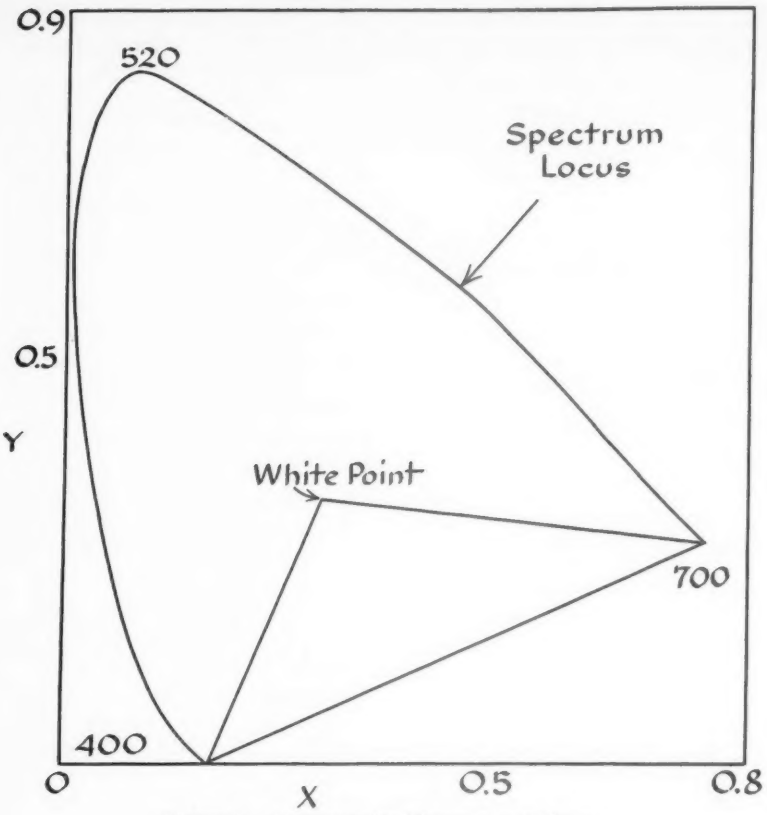


Figure 3. Chromaticity Diagram, x-y plane.

vice plots a complete curve 60 times per second, it is useful for monitoring rapid color changes which sometimes take place in chemical and biological materials.

Tristimulus Colorimeters

The combination of a spectrophotometer and the CIE system provide a fundamental method of color specification; also a detailed picture of a color system being studied that no other system can approach. However, it requires expensive equipment and is usually time-consuming in its application.

Short cuts in the form of simpler insturments are available. Among these are photoelectric tristimulus colorimeters. These are designed to yield the CIE tristimulus values, X,Y,Z, directly from meter readings. Three photocells are adjusted by color filters to respond proportionately to a combination of the CIE distribution curves. The difficulty has been to design filters to do this perfectly and the limitations of these instruments arise principally from the fact that color filters cannot be found which duplicate perfectly the desired tristimulus functions. The result is that true x and y chromaticity coordinates can be obtained only for near whites. The farther we are from the white point the greater the error in determining true x and y coordinates. To overcome these difficulties tristimulus meters are sometimes operated as difference meters when they are used to compare colors close together in color space.

The filters of these instruments pass broad wavelength bands so in general cannot be expected to give meaningful color curves.

Abridged Spectrophotometers

Other short cuts can be made by the use of transmittance or reflectance measurements at one or more wavelengths with a spectrophotometer or abridged spectrophotometer. The latter is a simplified and less expensive instrument in which wavelength regions are usually isolated by a number of filters which pass relatively wide bands. In this way we can often get a number or set of numbers which correlate with color or color change. A good example is furnished by the paper industry. The reflectance curve of unbleached sulfite pulp is low at 400 millimicrons and rises rapidly between 400 and 500 millimicrons at which point it levels off. Bleaching raises the curve much more in the region of 400 to 500 millimicrons than in the rest of the range. Consequently, reflectance in this range is a sensitive index of degree of bleaching. The paper industry



Figure 4. This latest model of General Electric's Recording Spectrophotometer draws a curve that is a complete and exact specification of a color. It measures transmittance or reflectance with a photometric accuracy of 1.0 per cent, its photometric precision is within 0.2 per cent, and it operates with a bandwidth of 10 millimicrons through the visible spectrum of 380 to 700 millimicrons. Reflectance curves are drawn on a basis of magnesium oxide as standard.

SCHEMATIC DIAGRAM OF GE'S RECORDING SPECTROPHOTOMETER

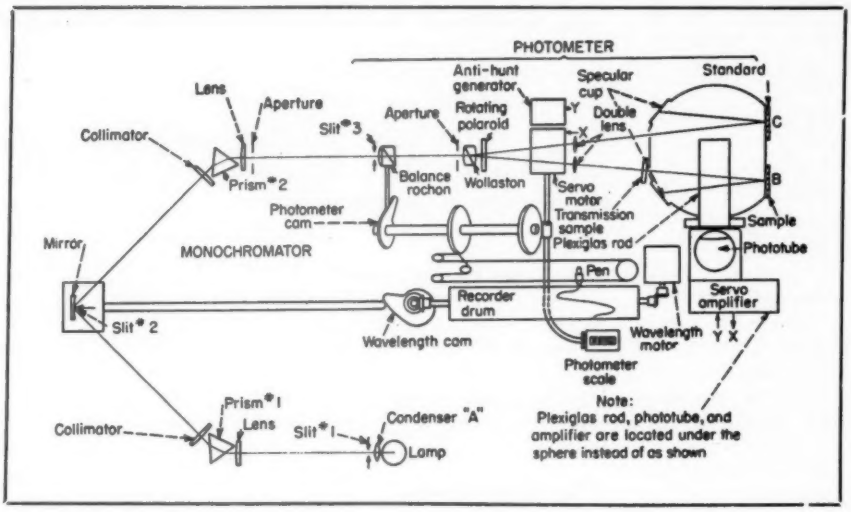


Figure 5. In this schematic diagram of the General Electric instrument, prism 1 disperses light from the lamp into a spectrum appearing in the plane of slit 2, which isolates a narrow band of wavelengths and passes it on to prism 2. This second prism disperses stray light into a secondary spectrum in the plane of slit 3, which passes only the spectral band isolated by slit 2. Slit 2 is linked to a wavelength drum on which chart paper is placed. The two are activated by a motor that moves slit 2 through the spectrum and turns the wavelength drum. As the spectrum is traversed the mechanical widths of the slits are continually changed to transmit a constant band of wavelengths, usually 10 millimicrons.

The monochromatic light transmitted by slit 3 passes in turn through (1) a balancing Rochon polarizing prism, (2) a Wollaston prism, where it is split into two beams polarized at right angles to each other, (3) a rotating Polaroid polarizer driven by a synchronous motor, (4) decentering lenses, (5) transmission compartment, and (6) integrating sphere- and is incident upon the reflecting samples at B and C.

As the Polaroid rotates, the intensity of the light incident upon B and C alternates between maximum and minimum in such a way that B is maximum when C is minimum, and vice versa. The effective frequency of the alternating component is 60 cps.

A photoelectric cell at the bottom of the sphere is connected to an ac amplifier and a servomechanism so that any alternating current from the photocell will drive the balance motor connected to the Rochon prism. The ac current phase will depend on which of the two energies reflected from B and C is greater. The balance motor is phased to reduce the ac signal to minimum and thus bring about a balance of energies reflected from B and C. When this is accomplished there is no torque on the motor, and it is at rest. The balancing Rochon is mechanically linked to a recording pen assembly, translating its angular setting into pen movement.

When a reflectance curve is to be drawn, the test sample is clipped into opening B and a freshly smoked magnesium oxide surface is clipped into opening C. Complete curves can be drawn in 1 or 2 min. at the choice of the operator. For transmission curves, both B and C are covered with high reflecting materials such as magnesium carbonate or oxide and the transmission sample is inserted on the opposite side of the integrating sphere. Typical charts and curves are shown in figure 2.

has standardized on reflectance measured at 458 millimicrons for this index. It is called paper makers' brightness.

Obviously, paper makers' brightness does not measure actual color. However, if the reflectance curves maintain the same general shape, paper makers' brightness is capable of differentiating between an acceptable product without recourse to any lengthy or involved process. It cannot be used with any degree of success on materials whose color curves differ essentially from those for which it was designed.

In spite of these drawbacks, abridged spectrophotometry offers the best opportunity for automation in color control. When a color control problem can be reduced to a one dimensional system, there is a good possibility that equipment can be designed to monitor and control the parameter involved. Unfortunately, the complexity increases rapidly with increase of parameters.

It is not the desire of the author on such a pessimistic note. Rather, it has been the purpose of this discussion to point out the difficulty of the problem as an answer to our original question, "Why not automation in color?" Increased color knowledge and improved technology along with American ingenuity can be counted to continually improve our tools of color measurement, control, and even automation.

AUTOMATING PAINT MANUFACTURE

Economic and technical factors are assessed in determining the feasibility of automatic control in the German paint plant

By Kaspar Engels*

IN many publications about automation favorable opinions alternate with the unfavorable. Because automation has received much publicity, managers must become familiar with the problems associated with automation. Much has been written in the United States but even there automated plants are limited. In our attempt to analyze the problem we should start with economic calculations, relating production with investment, labor, and production costs. Circumstances differ greatly from plant to plant. A complete analysis, therefore, can only be made for some specific case. Also of importance is how the machine influences the quality of the end product. Automation is important because greater economy could be realized. On the other hand, there is an inclination to postpone modernization because of so many uncertainties.

Definition

It is not possible to separate the idea of automation completely from increase in productivity and from maximum economy. The increase in productivity is directed toward attaining the greatest production for the least effort. Maximum economy aims for the highest output with lowest cost by standardizing and simplifying as well as by saving human muscular power. Automation also means the exclusion of human labor not only as far as muscular power is concerned, but also of intellectual power. The essence of automation is production, where measurement and direction are automatic. Human labor is not necessary except for supervision and maintenance.

Tools of Automation

In automation, extremely precise measurement and weighing are essential. They replace human labor by directing input. Metering can be done batchwise or continuously depending upon the circumstances. The total production process must be complexly mechanized.

One can use pneumatic or hydraulic working machinery as well as electronic and electrical controls. In general, electrical equipment can handle any problem, and is considered safe and dependable. Electronic installations need less space and respond more rapidly. High speed is only of importance when a great number of operations have to be accomplished in a very short time. The total field of automatic control with exclusion of human labor is called "Cybernetics", a word coined by the inventor of the electronic brains. Like the word "Automation" the word "Cybernetics" is also difficult to define sharply.

Conditions for Automation

Although it is technically possible to automate any production process, only in few cases it can be done economically. The desired qualities of the final product and the properties of the raw materials must be analyzed. The product must be made in the largest possible quantity and of a strictly defined quality. Because practically every paint plant makes so many different kinds of paints, large quantities are rarely produced.

Automation requires an organized market. For automated production of one single product, there are two possibilities. In one case we can use a complete production line for each single product. In the other case we could use appropriate controls to be able to make several products on the same line. Standardization can be of great help here. Because there are many possibilities for error and because of the many deviations of the physical properties, avoid striving for higher quality than necessary.

Particle size of pigments and mill processes directly influence the regulation of the machine. In batch processes we could include an appropriate safety factor to obtain sufficient security from deviations. In continuous processes, continuous control must be excericised. Optical methods could perform this task, but because of high costs they have not yet been fully developed. Production lines should be fed completely automatically. Therefore, it is desirable to formulate the product with the least possible number of components.

Storage of raw materials in units, like bags, etc., might be just as profitable as storage of raw materials in bulk. If we feed small units we need less measuring instruments than with feeding from bulk. The location of the storage place is extremely important and unusually careful timing of purchase of raw material is essential.

*An extensive summary of two articles in *Farbe und Lack*, **63**, 1-4 and 70-75. (Jan. and Feb., 1957).

Machines

It is not expected that basically new dispersing processes will be introduced in the paint industry. A careful calculation of a specific case will enable us to decide whether automation is favorable. Some mills are most effective for one single produce. Others can be adapted to several products. It is desirable to do as many possible operations in one single machine. We can use ball mills for milling as well as for mixing with thinner. A roller mill must be preceded by mixers and followed by thinner tanks.

The differences between batch processes and continuous processes are not essential for automation. The advantages of a continuous process are decreased by more complicated control instruments. One hundred per cent automation should immediately correct the feeding speed as well as the positions of the rolls of the mill. This means automatic stopping of the machine when material shortages occur and alarms in the case of change of the properties of the material. A ball mill can be provided with an automatic stop after a certain time and automatic discharge and recharge. The batch process for mixing and thinning has the advantage of relatively simple handling and weighing procedures. A drawback is the great quantity of components and the great number of manipulations required for each batch process.

For continuously operating machines like roller mills, continuous mixers are desirable. Theoretical calculations of the variances and deviations from the average becomes very important in this case. In contrast to the grinding machinery there are new aspects for mixing with automation, and the great advantage is, that we can use the old machines.

As an example there are different ways in which an automated plant could work. A complete plant constructed for the production of one single product consists of bulk storage, metering equipment, continuously operating mixers, roller mills, thinner tanks, and a packaging line. It is automated if the production is carried on without human aid other than supervision. The same product could be produced however, by using batch process mixers, roller mills and thinner tanks. By means of suitable punch cards batches-in-process could be directed to various mills and tanks for processing. This is a more complicated way but a higher production is possible. Most companies actually want semi-automatic machines which can fit into a continuous mixing and milling operation. It is possible that experience with screw conveyors may lead to new process designs.

Human Labor

Automation is sometimes more desirable because it avoids the use of personnel. Automation generally permits higher salaries which makes it easier to get and keep personnel. Automation is always begun by a careful analysis of human labor in the production process. As a consequence of this, the most rationalized plant will be most prepared for automation. Automation will never eliminate completely human labor. The necessary human labor can be applied at the beginning, during, or at the end of the production.

We still have to think of another important and elaborate detail, the cleaning of the machines and tanks. Machines for cleaning without use of the human eye would be extremely complicated. Automated cleaning would require a special cleaning plant apart from the production plant. Because of the complexity of the cleaning, production has to be organized in such a way that cleaning can be eliminated as much as possible. This makes it desirable to have a complete production line for every color of every product. Moreover, the production of this line should not be interrupted.

Working Hours

It is now customary to use mills on a 24 hour schedule. Continuous production means higher production with the same investment, but it will cause a more rapid depreciation. It does not mean less human labor. On the contrary, labor costs are higher with night shifts. In an automated plant, production goes on without human labor except for supervision.

Continuous production means no increase in the cost of labor. Because of the high sums of invested money in an automated plant, continuous production cannot be avoided. Labor for cleaning is saved by continuous production. At the start of production all the machines have to be adjusted and checked. These two factors make continuous production necessary.

The high cost of the installation makes it advisable to continue production on Sundays and holidays. This makes sense only if the production is in equilibrium with the demand so that quality or color does not have to be changed. If something has to be changed, which means the production has to be interrupted, it should be wise to do it on Sundays or holidays. Progressive sales planning is therefore necessary.

Plant Planning

Many plants store raw materials separately from the production sections. The large number of raw materials in most companies requires large stock and long storage time. With automation, reduction of the number of components becomes imperative. This reduction will be possible only by reducing the diversification of the production. In automated plants it is necessary to connect the storehouses directly with the production. The extent of this concentration is limited by social, fire, and safety laws.

The norm of construction for the building is maximum possible supervision by the least possible number of persons. In ideal cases, this supervision should be done by one person by direct view. If this is impossible, control can be done by television.

The machines have to be placed in such a way that transportation involves the least energy. Gravity will suffice in general. This involves tall buildings. Horizontal or vertical construction will hardly exist in an automated plant; rarely will processing machines be installed within the floors of the building.

The whole production process has to be seen as one initially without a building. The controls have to be placed in a suitable location regardless of the building. Over the contours of the production unit a protective building has to be

erected. It is possible that future paint manufacturing buildings will be constructed in a way which is customary for power houses and boiler houses. The total depreciation of the building has to occur at the same rate as the machinery. Because of rapid evolution, such construction will be planned only for a short life period.

The use of prefabricated construction elements might be of advantage to adapt the building to changes in installation. Perfect air conditioning is of importance in automated plants because good performance of the directing automats depends on the complete absence of any fluctuations. Windows are not necessary.

Investments

In completely automatic paint plants the costs of material-handling equipment, the adaptation of the mills and the required controls are many times higher than the price of the traditional man-operated mills. The high cost necessary to mechanize the transport lines justifies arrangement of the production stream without considering the cost of the building.

It is necessary to study the effect on the cost of labor together with the investment costs. It should not be forgotten that, in addition to supervising personnel, guards will be necessary. Maintenance costs probably will be considerably higher.

Weighing and Metering.

Here we have to distinguish between the batch process and the continuous process and the requirement of solid as well as liquid raw materials. For batch processes we can use tanks with vibration belts and weighing machines. The different components are transported one after the other to the mixing kettle. The weighing tanks could be directed by means of punched cards. Liquids can be measured volumetrically. Repetition can be directed by timing or by the movements in the mixing tanks (i.e. level measurement).

For accurate and continuous weighing of pigments, there are problems. If volumetric measurement is satisfactory, screw conveyors or vibration belts can be used. In practice, most continuous installations work with a large number of small scales.

Liquid quantities are more easily controlled as long as the density is constant. Continuous addition can be obtained by variation of the pump speeds. The time of addition can be varied in many ways.

Mixers

It has been mentioned previously that it is desirable to combine milling and mixing in one machine. This, however, is only possible in a batch process. To feed batchwise working mixers we need a double set of feed tanks. The discharge of mixed materials has to be directed by the control on the feed funnels of the mills.

For further continuous operations, it is advisable to have continuous mixers. The continuous mixers now available are difficult to regulate. The different components have to be added continuously and the production has to be completely adapted to subsequent milling operations. Unfortunately it is impossible to calculate the average capacity of a roller mill because of wide variations in capacity. Roller mills are very sensitive to temperature variations of the rolls, the type of millbase and the blade setting. Without directing devices, these variations would cause a lack or surplus of finished material if the mixers work constantly.

Batchwise Working Mills

These mills in general are able to mix the raw materials as well as to mill them. Moreover, at the end of the milling process, thinners can be added. This means that the charge of the ball mill has to be kept relatively low. If we charge the ball mill so that the surface of the balls are just covered, we greatly reduce the milling time. The free space in the mill in general is sufficient for the addition of the total amount of thinner.

The packaging line can be connected directly with the ball mill. The ball mill is only efficient for large quantities. In automatically working plants a roll mill would be fed out of the storage tanks by gravitation. Gravitation would feed the packaging line directly from the ball mill. This easy arrangement is important for the dry materials, the liquids can be easily transported with pumps. The arrangement of the packaging line depends on the size and the kinds of the units to be delivered.

Homogenizers

With homogenizers we mean mixers with the most diversified form of propellers which are able to disperse pigments intensively enough to obtain acceptable paint. As the effect is a function of the time, the quality of the product is easily to regulate. As they work batchwise, the feed and discharge mechanisms are similar to those of the ball mill.

Dispersion Mixers

The dispersion mixer requires arrangements similar to those of the ball mill. No thinner can be added here; so a separate thinning tank is necessary.

Continuously Working Mills

Funnel mills have a low output. Continuous control is therefore necessary. The capacity depends on the viscosity of the products as well as on the temperature phenomena. These factors have to be observed continuously.

The arrangement in the production process is equal for all the continuously working mixers. An exception could be made for the funnel mill, where a mixing process could be performed in the funnel. As roller mills are inclined to sift out certain pigments they should be followed by a mixing tank for control. The thinner tanks following have changed to enable automatic control.

Dispersion screw work with highly viscous liquids. This makes addition of thinner impossible. With special feed mechanisms at the outlet enough thinner can be added to enable the addition of the rest in a mixing tank. The greatest problem is to maintain low variations in formulation.

Old Plants or New Ones

As new techniques are developed, it is probable that the automation in the paint industry will start with the automation of small sections.

This will be done within the old production units. If experience shows strong advantages for automation, it might be possible that greater units will be constructed. In both cases it is necessary to test in detail which advantages will bring automation.



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PROGRAM
35th FEDERATION ANNUAL MEETING

WEDNESDAY, OCTOBER 30

10:00 a.m. Club Council Representatives Caucus

1:15 a.m. Federation Council Meeting

THURSDAY, OCTOBER 31

10:00 a.m. Meeting Opens
Invocation—Verne C. Bidlack
Greetings—Milton A. Glaser
Welcome—P. J. Whiteway, Jr., Chairman of Host Committee

10:20 a.m. "A Study of Pigment Dispersions: VI"—New York Club

10:40 a.m. "Solubility Parameters of Resins"—C.D.I.C. Club

11:00 a.m. "Description and Evaluation of Kansas City Club Sag Tester"—Kansas City Club

11:20 a.m. "Evaluation of Dry Spackling Compounds for Interior Walls"—New York Club

11:40 a.m. Keynote address—Dr. Roger H. Lueck, Vice-President, Research and Technical Dept., American Can Company

2:00 p.m. "Anti-Rust Additives in Primer Paints"—Golden Gate Club

2:20 p.m. Address by Joseph F. Battley, President of the National Paint, Varnish and Lacquer Association

2:30 p.m. "A Solvent Formulating Chart"—Harry Burrell (A Roon Award Competition Paper)

3:00 p.m. Open Forum Sessions by "Colonel" Billy Hood

3:40 p.m. "Color Stability of Red Oxide Pigments"—Philadelphia Club

4:00 p.m. "Effect of Solvent Properties on the Viscosity of Alkyd Resin Solutions"—W. W. Reynolds and H. Gebhardt, Jr. (A Roon Award Competition paper)

4:30 p.m. Annual Business Meeting

FRIDAY, NOVEMBER 1

9:00 a.m. "Instrumental Color Reproduction of Paint"—Baltimore Club

9:20 a.m. "Selections of Optimum Source of Artificial Illumination for the Matching of Colors"—Philadelphia Club

9:40 a.m. "Development of Flat Wall Paint Scrubbability Method"—New York Club

10:00 a.m. Panel Discussion—"Material Handling"

11:30 a.m. Annual Joseph J. Mattiello Memorial Lecture—"Pigment Vehicle Interface"—Dr. Albert C. Zettlemoyer, Professor of Chemistry, Lehigh University and Director of Research, National Printing Ink Research Institute

SATURDAY, NOVEMBER 2

9:00 a.m. "Correction Factors Applied to Carother's Equation for Condensation Polymerization"—R. F. Carmody (A Roon Award Competition paper)

9:30 a.m. "Adhesions and Adhesives"—Dr. J. S. Long, W. L. Yuan, and R. J. Curran, University of Louisville Institute of Industrial Research

9:50 a.m. "Solvent Free Epoxy Amine Systems"—Dr. G. H. Ott (FATIPEC Paper)

10:30 a.m. Panel Discussion—"An Approach to Formulation and Control"

2:00 p.m. "Use of Hexylene Glycol and other Solvents in Styrene-Butadiene Latex Paint"—Roy W. Tess and Robert D. Schmitz (A Roon Award Competition paper)

2:30 p.m. "Development and Use of Sand Grinder"—David G. Bosse, E. I. DuPont de Nemours & Co., Inc.

SOCIAL EVENTS

Thursday, October 31, 12:30 p.m.

Canadian Luncheon and North Dakota State College Alumni Reception

Friday, November 1, 7:00 p.m.

Annual Banquet, Entertainment and Dance

REGISTRATION

Wed.	*Oct. 30*	*11:00 a.m. - 5:00 p.m.*
Wed.	*Oct. 30*	*7:00 p.m. - 9:00 p.m.*
Thurs.	*Oct. 31*	*8:00 a.m. - 5:00 p.m.*
Fri.	*Nov. 1*	*8:30 a.m. - 4:30 p.m.*
Sat.	*Nov. 2*	*8:30 a.m. - 12:00 noon*



MILTON A. GLASER
President

Officers Federation of Paint & Varnish Production Clubs 35th Annual Meeting





JOSEPH W. TOMECKO
President-Elect



HOWARD G. SCHOLL
Treasurer



C. HOMER FLYNN
Executive Secretary

EXHIBITORS at 22nd PAINT INDUSTRIES' SHOW

A

PAUL O. ABBE — Booth 210
Little Falls, N. J.
Ball and Pebble Mills, Mixers, Rota-Cone Blenders and Vacuum Dryers.
Garlick Ringen Fuller Sindle
DuVall

ADVANCE SOLVENTS & CHEMICAL — 217-218
Division of Carlisle Chemical Works, Inc.
New Brunswick, N. J.
Zirco and Control Paint Specialty items.
Gregg Burger Tucker Frankel
— See Advertisement Front Cover —

C. M. AMBROSE COMPANY — 209
Seattle, Wash.
Self Cleaning Strainer, Filling and Sealing Machines
Ambrose McMackin Styba Turner
— See Advertisement Page 106 —

ANDERSON-PRICHARD OIL CORPORATION — 1858
Oklahoma City, Okla.
Solvents and Thinners
Dresser Easterday Rubek Gault
Centracco Phillips Fessler Bettis
Zimmermann Lawson Brock Long
Johnson

ARCHER-DANIELS-MIDLAND COMPANY — 211-212
Minneapolis, Minn.
Alkyds, Rosin Esters, Modified Rosin Esters, Pure Phenolic Esters
Technical representatives from all the departments.
— See Advertisement Page 13 —

ATLAS ELECTRIC DEVICES COMPANY — 105
Chicago, Ill.
Weather-Ometer
Norton Metzinger Monaghan
— See Advertisement Page 114 —

B

BAKELITE COMPANY — 201, 202, 203
Division Union Carbide Corporation
New York, N. Y.
Vinyl Acetate Latex WC-130, Phenolic-Vinyl Primer, Vinyl Solution Coatings
Brennick Calsibet Droman Fryman
Given Ingram Larson Martell
Norum Schwahn Shoemaker Swain
Young
— See Advertisements Pages 9, 10, 11, 12 —

BAKER CASTOR OIL — 1821
Bayonne, N. J.
Thickening Agents and Plasticizers
Hayes Jubanowsky Patton Metz
Reilly Harrow Ottens

BARRETT DIVISION — 1811, 1813
Allied Chemical & Dye Corporation
New York, N. Y.
Phthalic Anhydride, Plasticizers, Cumar Resins, Plaskon Coating Resins, (Alkyd, Urea, Melamine, Phenolic, Maleic, Ester Gum, Silicone-Alkyd, Styrenated Alkyd)
Miller Cislo Barry Stocker
Carney Schmitt Styles De Vore
Pitcher Yanason Boardman Ironside
McMillan Stumpe Delaney Ginsler
Davis Hoppens
— See Advertisement Pages 4, 109 —

BENNETT INDUSTRIES, INC. — 1877
South Chicago, Ill.
Pails and Drums, Special Mixing Tanks, Tubs
Bennett LePan Ernst Kuckie
Kapsa

BORDEN COMPANY — 1809-1810
Chemical Division, Polyco Monomer Dept.
New York, N. Y.
Latex Paint Vehicles (Acrylic, Butadiene-Styrene, Polyvinyl Acetate)
Smith Lowry Galbraith West
Gordon Ziemer Missbach
— See Advertisement Page 107 —

BUCKMAN LABORATORIES, INC. — 118-119
Memphis, Tenn.
Panels showing results of using preservatives in paint systems
Buckman Dietzel O'Connor Ross
Stitt West Wienert

C

GODFREY L. CABOT, INC. — 1871, 1873
Boston, Mass.
Carbon Blacks, Cab-O-Sil, Wollastonite
Berstein Browning Carpenter Clark
Magno Marsh McNeil Roemelt
Woods

CAMBRIDGE INDUSTRIES COMPANY — 1827
Cambridge 42, Mass.
Resinous Plasticizer for PVA Emulsions
Pockel J. Stone M. Stone

CARGILL, INC. — 1829
Minneapolis, Minn.
Linseed Oils, Soybean Oils, Fish Oils, Alkyd Resins
Klobe Kantor Stanton Crocker
Weisman Rogaliner Kamen Knott
Yarger Whiting Patten Simmonds
Wink
— See Advertisement Page 23 —

CARBOLA CHEMICAL CO., INC. — 108
Natural Bridge, N. Y.
Paint Extender Pigments
Koenig Rogers Spriggs Roast
Henrik Heikel

CARBON DISPERSIONS, INC. — 107
Newark, N. J.
Carbon and Lamp Black Dispersions
Brauch Keegan
— See Advertisement Page 167 —

CATALYTIC COMBUSTION CORPORATION — 1807
Detroit, Mich.
Fume Disposal Systems
Donahue Goodell Grimac
Ruff Tonkonogy

CELANESE CORPORATION OF AMERICA — 219-220
Chemical Division
New York, N. Y.
Solvents and Plasticizers
Kampshulte Hecht Werner Baker
Davis Smith Polacek Gerry
Bartley Wilbur
— See Advertisement Page 96 —

CELANESE CORPORATION OF AMERICA — 1833
Plastics Division
Newark, N. J.
Polyvinyl Acetate Homopolymer and Copolymer for Architectural Paint and Industrial Finishes
Representatives from research and technical service laboratories
— See Advertisement Page 135 —

CELLOFILM INDUSTRIES, INC. — 207
Woodridge, N. J.
Nitrocellulose Solutions in Lacquers and Protective Coatings
Golden Eysmann Bromley

EXHIBIT HOURS

Wed., Oct. 30, 1-5
Thurs. Oct. 31, 12-6
Fri., Nov. 1, 9-5
Sat., Nov. 2, 9-3

CIBA COMPANY, INC. 1837
Kimberton, Pa.
Epoxy Resins
Joseph Busker Scales Dorman Maslow
— See Advertisement Page 143 —

COLTON CHEMICAL CO. 1874, 1876
Division of Air Reduction, Inc.
Cleveland, Ohio
PVA Emulsions
Ames Ostrow Hill Kaine
Stettler Rhines Jaffe Fickenscher
Werner Krashin Coff Greenfield
Kimmel Kohl Gaffney

COLUMBIAN CARBON CO. 1843
New York, N. Y.
Iron Oxides, Bone Blacks, Carbon Blacks, Aqueous Dispersions, Base Dispersions
Brannan Kocik Keating Condron
True Snyder Loges Kealy
Katona Venuto Foster Bryant
— See Advertisement Page 92 —

COMMERCIAL SOLVENTS CORP. 1817-1819
New York, N. Y.
Nitroparaffins
Maple Luedeke McInnes Junker
Morhman Erwin Hopkins
— See Advertisement Page 103 —

CUNO ENGINEERING CORP. 206
Meriden, Conn.
Paint Filters—cartridge and self-cleaning types
Grupe Holder Palmer Fugett
Toebe
— See Advertisement Page 166 —

D

DANIEL PRODUCTS CO. 1803
Jersey City, N. J.
Pre-dispersed Bentone Paste, Tinting Colors, Silica Flatting Bases, Black Enamel Bases
Daniels

J. H. DAY COMPANY 112, 113
Division of Cleveland Automatic Machine Co.
Cincinnati, Ohio
Mixers and Roller Mills
Diltz Russell Harris Wershay
— See Advertisement Page 130 —

DEWEY AND ALMY CHEMICAL CO. 1866
Division W. R. Grace Co.
Cambridge 40, Mass.
Vinyl Acetate Polymers and Copolymers, Styrene-Butadiene Copolymer Latices, Styrene-Butadiene Resins, Plasticizers, Dispersing Agents
Technical representatives from all departments

DOW CHEMICAL CO. 1847-1849
Midland, Mich.
Dow Latex 566, Dow Latex 762-W and 762-L, Styrene, Vinyltoluene, Saran Resin F-120
Morand Haskell Peterson Carpenter
Johnson
— See Advertisement Page 8 —

DOW CORNING CORP. 1850
Midland, Mich.
Silicone Paint Additives, Silicone Intermediates, Silicone Resins, Silicone Masonry Water Repellants
Vidal McLean Hedlund Francisco
Tyler

E. I. DUPONT DE NEMOURS & CO., INC. 1869
Electrochemicals Dept.
Wilmington, Del.
PVA Emulsions
Beardsley Beeman Byrum Czerwin
Dustman Seidel Sawyer
— See Advertisement Page 121 —

E

EASTMAN CHEMICAL PRODUCTS, INC. 1861-1862
Kingsport, Tenn.
Half-Second Butyrate in metal finishes, Plasticizers and Solvents
Coney Von Bramer Gearhart Lee
Ball Crowley Reebel Moore
— See Advertisement Page 14 —

F

FARNOW, INC. 1870
Long Island City, N. Y.
Flat Alkyds, Emulsions Resins, Varnishes for Wrinkle Finishes
B. Farber S. Farber Bauman Freund
Shandler Saputo Kristeller
— See Advertisement Page 125 —

FIRESTONE PLASTICS COMPANY 1875
Chemical Sales Division
Pottstown, Pa.
Vinyl Solution Resins
Kerchner Boyer Thompson
Johnston Kuhn
— See Advertisement Pages 30, 31 —

G

GENERAL ELECTRIC 1856
Chemical Materials Dept.
Pittsfield, Mass.
Methylon Resins
Ackerman Chase Decker Eber
Irish Somers Young

GENERAL MILLS 102
Chemical Division
Kankakee, Ill.
Fatty Acids and Derivatives, Polyamides Resins
Van Oehsen Murphy de Meurisse Boyd
Ritell McNamara Herban Kron
Price Hanson

GENERAL TIRE & RUBBER COMPANY 106
Chemical Division
Akron, Ohio
Latices and Latex Formulations
Kreider Meincke Reeves Rollick

GOODYEAR TIRE & RUBBER COMPANY 1822-1826
Chemical Division
Akron, Ohio
Pliolite S-5, Pliolite Latex
H. Thies McNeer Warner Platner
Hussey Neese Bear Wallace
Kann Kelly Hickcox Smith
Barnum L. Thies Talley Houlette

H

THE HARSHAW CHEMICAL COMPANY 1831-1832
Cleveland, Ohio
Driers, Stearates, Yellow and Red Cadmium Lithopones, Sun Yellow C and N, Organic Pigments, Aurasprese Color Dispersions
Close Dickenson Molinari Stacy
Straka Unkefer Coleman Reilly
McGuire Hummel Baldwin
— See Advertisement Page 14 —

HERCULES POWDER COMPANY 1835-1836
Wilmington, Del.
Cellulose Derivatives, Chlorinated Rubber, Pentaerythritol, Synthetic Resins, Rosins, Modified Rosins, Tall Oil Fatty Acids
Technical representatives from all departments.
— See Advertisement Page 137 —

HEYDEN NEWPORT CHEMICAL CORP. 1863
New York, N. Y.
Trimethylolethane, Anti-Skinning Agents, Gloss Oils, Rosins, Tall Oil Products, Terpene Solvents, Terpene Chemicals
Sales and technical representatives.

HILTON-DAVIS CHEMICAL COMPANY 1801
Cincinnati, Ohio
Flushed and Dry Color pigments
Langner Knaggs Martin Gurska
Fletcher Stephany Moore

HERMAN HOCKMEYER & COMPANY 104
New York, N. Y.
Mixing Machinery and Process Equipment
Hockmeyer Klein

I

INSTRUMENT DEVELOPMENT LABS. INC. 1851B
Needham Heights, Mass.
Model C Color Eye, Delta E Color Tolerance Computer
Hall

INTERNATIONAL TALC COMPANY 111
New York, N. Y.
Paint Extenders
Smart Patterson Tuttle McCarthy
— See Advertisement Page 104 —

K

SPENCER KELLOGG & SONS, INC. 1854-1855
Buffalo, N. Y.
Spen Kel (Polyurethane Line), Keltrols (Vinyltoluene-Vegetable Oil-Copolymers)
Healy Nagel Beyer Farstad
Bristol McCready Bieneman
— See Advertisement Page 83 —

KENT MACHINE WORK, INC. 1840
Brooklyn, N. Y.
Mixing and Grinding Machinery
Peters Weitzner
— See Advertisement Page 159 —

KINETIC DISPERSION CORPORATION 208
Buffalo, N. Y.
Kady Mills
Kew Behrns Wheeler Wallace
Hiller

KOPPERS COMPANY, INC. 1846-1848
Pittsburgh, Pa.
Styrene-Butadiene Latex
Carlson Gogek Guy

L

LACQUER INFORMATION CENTER 1864-1865
Latest Developments in Lacquer Technology, Formulations and Applications
Antara Chemicals Division
Celanese Corporation of America
Columbian Carbon Co.
Davison Chemical Co.
Enjay Company
Hercules Powder Co.
Olin Mathieson Chemical Corp.
Shell Chemical Company
Union Carbide Chemicals Co.
William Zinsser & Co., Inc.

J. M. LEHMANN CO., INC. 1820
Lyndhurst, N. J.
Sight-O-Matic Mills, Vorti-Siv-Twin Mixer
Dittmann Muller Page Hoffman
— See Advertisement Page 19 —

M

MACBETH DAYLIGHTING CORPORATION 120
Newburgh, N. Y.
Color Matching Daylight Lamps
Reese Meeker Willett McCurdy
— See Advertisement Page 154 —

METALS DISINTERGRATING COMPANY, INC. 1815
Elizabeth, N. J.
Aluminum Pastes and Powders, Gold Bronze Powders
Collins McKinley Town Sheaffer
Cliffe
— See Advertisement Page 144 —

MINERALS & CHEMICALS CORPORATION OF AMERICA 1818
Menlo Park, N. J.
Aluminum Silicate Pigments in Outside Paints
J. Wheeler Wilcox Smith Dilley
P. Wheeler Albert Hubbell
— See Advertisement Page 116 —

MINERAL PIGMENTS CORPORATION 221
Muirkirk, Maryland
Dry and Pulp Colors, Natural Synthetic Iron Oxides, Inorganic Chemical Colors, Chromium Oxide
Scowe Hartmeyer Weisberg Foos
Robinson Libby Insley Devine

MOBAY CHEMICAL CORPORATION 1877
Pittsburgh, Pa.
Urethane Chemicals, Mondur Isocyanate, Multron Polyester
Bruck Wells Sansone Hudson
McGregor

MONSANTO CHEMICAL CO. 1823-1825
Springfield, Mass.
Amino Resins, Phenolic Resins, Styrene Latices, Polyelectrolytes, Lytron 680
Jones Watt Gordon Parker
Hahn Homuth Francis Brown
MacPherson Green Schmidt Cochran
Werner Traverso Wiese Ellicott
Dow
— See Advertisement Page 93 —

MOREHOUSE-COWLES, INC. 1830
Los Angeles, Calif.
High Speed Attrition Mills, Dissolvers, Pilot Plant and Laboratory Equipment
Representatives from all departments.

N

NAFTONE, INC. 1859
New York, N. Y.
Driers, Anti-skinning Agents, Latex Base, Preservatives, Soy Lecithin Products
Applegate Klebsattel McTavey
Martin Smith
— See Advertisement Page 124 —

NATIONAL ANILINE DIV. 1857
Allied Chemical & Dye Corp.
New York, N. Y.
Anhydrides, Dicarboxylic Acids, Anti-Skinning Agents, Isocyanates, Detergents, Curing Agents
Bailey Bond Croce Gardner
Johnson Kirk MacDonald Mitchell
Morgan Reed Rhodes Seigle
Sullivan Toone Urbowicz Wilson
Wizemann
— See Advertisement Page 29 —

NATIONAL PAINT, VARNISH AND LACQUER ASSOC. Burgundy Rm.
Washington, D. C.
Miniature Paint Factory (Modern and 70 years ago)
Loucks Shurts Scofield Garlock
Odell Rowland

NEVILLE CHEMICAL CO. 1812-1814
Pittsburgh, Pa.
Coumarone-Indene and Heat Reactive Resins, Nevillac Hard Resin for Anti-Skinning and Anti-gelling Purpose
Dauler Evans Freeman Wald
Craig Isenberg Marsh Villing
— See Advertisement Page 33 —

NOPCO CHEMICAL CO. 1860
Harrison, N. J.
Anti-Foamers, Dispersants, Thickeners, Freeze-Thaw Stabilizers, Surface Active Agents, Mettalic Soaps (Metasap Chemical Co.)
Lohrke Licata Silvain Riley
Arthur Leonard Spain Gavin
— See Advertisement Page 146 —

NUODEX PRODUCTS CO. 1805-1806
Elizabeth, N. J.
Nuozene (germ-proof and mildew resistant additive), Paint Additive Line
Clark Dwyer Goodfellow Houston
Kiernan Kaiser Klens Lang
Minich Ritter Serkanic Seymour
Stewart
— See Advertisement Page 120 —

O

ORONITE CHEMICAL CO. 114
San Francisco, Calif.
Phthalic Anhydride, Isophthalic Acid, Phenol
Billings Burkel Colaianni Gould
Petersen Stephenson Van Buskirk
— See Advertisement Page 133 —

P

PATTERSON FOUNDRY AND MACHINE CO. 204-205
Subsidiary Ferro Corp.
East Liverpool, Ohio
Mills, Synthetic Resin Plants, High Density Mill Linings and Grinding Media
Dolan Gantt Jacobson Witherow
Hood Milburn Henszey Wright
Jebens Sisson Campbell Stephenson
— See Advertisement Page 145 —

PENNSALT CHEMICAL CORPS. 1837B
Philadelphia, Pa.
Solvents, Anti-Livering Agents, Anti-Skinning Agents, Emulsifiers, Dispersion Aids, Stabilizers
Eaton Nevers Lederman Geiser
Conyers Capron McKinney

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP. 1868
Clairton, Pa.
Piccopole Emulsions, Piccolytes, Piccolastics, Picco Resins
Technical representatives from all departments.

Q

Q-PANEL CO. 1849-B
Cleveland, Ohio
Steel Test Panels, Phosphate-Coated Steel Panels, Aluminum Test Panels, Treated Aluminum Test Panels, Curved Panels for Displaying
Grossman Antonik Chirdon

R

R-B-H DISPERSIONS 200
Div. of Interchemical Corp.
Bound Brook, N. J.
Pigment Dispersions
Lynch Steidings Conklin Rost
Bresky Remacle

RAYBO CHEMICAL CO. 1828
Huntington, W. Va.
Paint Additives
Hepner Plymale

REICHARD-COULSTON, INC. 115
New York, N. Y.
Iron Oxide Colors and Pigments
Coulston Smith Woodruff Burns
Treade Howe

REICHHOLD CHEMICALS, INC. 1851-1853
White Plains, N. Y.
Line of Urea and Melamine Resins
Baker Bloomquist Breedlove Drake
Fay Hafeli Helbig Knauss
Pinkerman Weismann
— See Advertisement 2nd Cover —

ROHM & HAAS CO. 1839, 1841
Philadelphia, Pa.
Acryloid Resins, Rhoplex AC-33, Uformite F-222, Uformite MM-57
Adamson Alcorn Allyn Cheetham
Collins Elliott Evans Gibson
Graeff Gusman Harland Harren
Jaggard Klein Lamy Lyons
Prentiss Sayer Smith Staines
Tetzlaff Timmons Toussaint Urquhart
Wright Wilkinson Wood
— See Advertisement Page 15 —

CHARLES ROSS & SON CO., INC. 121
Brooklyn, N. Y.
High Speed Roll Mills, Double Arm Kneaders, Dissolvers, Change Can Mixers, Paste Mixers, Laboratory Mixers and Mills
L. Ross C. Ross Teleky
— See Advertisement Page 35 —

ROSS & ROWE, INC. 1816
New York, N. Y.
Soybean Lecithin, Interface Modifiers
Hilty McAuley Kruse Schlesinger

S

SHAWINIGAN RESINS CORP. 1838
Springfield 1, Mass.
PVA (Gelva) Emulsions, Formvar-Butvar Resins
Dunning Bromley Wilson Finsilver
Poole Terry Roth Hoyt
Young Ash Kocher Manning
Hill Godsell
— See Advertisement Page 94 —

SHELL CHEMICAL CORP. 116, 117
New York, N. Y.
Epoxy Resins, Glycerine, EA, EAK, MIBK, MEK, DMK, MIBC, IPA
Sales and technical service representatives.
— See Advertisement Page 6 —

SHELL OIL CO. 109, 110
New York, N. Y.
Petroleum Solvents
Shaffer Prew Conn Waters
Reynolds Larson Ferrucci Carnahan
Dixon Irwin Kingsbury McHenry
Seelback Sliwa Thomas
— See Advertisement Page 118 —

SILBERLINE MANUFACTURING CO. 1867
Stamford, Conn.
Aluminum Pigments
Scheller Smith Usowski

SPARKLER MANUFACTURING CO. 1872
Mundelein, Ill.
Varnish Filter, Dual Disc Filter
Kelly Yeiser Sharbaugh
— See Advertisement Page 172 —

T

THE THIBAUT & WALKER CO., INC. 1878
Newark, N. J.
Alkyds, Varnishes, Lampblack Dispersions, Carbon Black Dispersions, Concentrated Stains, Specification Vehicles
Dunn Parker Sigafoose Edelstein
VanTuin Nortman

TROY CHEMICAL CO. 1802
New York, N. Y.
Fungicides and Driers
Dowdy Goll Singer
Snyder Sockloff Wilkington
— See Advertisement Page 119 —

TROY ENGINE & MACHINE CO. 101
Troy, Pa.
Roller Mills, Colloid Mills, Angular Mixers, "Duplex" Disperser
Parsons Brasington Harrigan
— See Advertisement Page 108 —

U

UNION BAG-CAMP PAPER CO. 1834
New York, N. Y.
Tall Oil Line
Doran Phelps Fiscella Zachary
Johnson Corso
— See Advertisement Page 148 —

UNION CARBIDE CHEMICALS DIV. 213-214
Div. Union Carbide Corp.
New York, N. Y.
Cellosize Hydroxyethyl Cellulose for Latex Paints, High Ester Solvents for Polyurethane Coatings, Solvents and Plasticizers for Furniture Formulations
Technical representatives from all departments.
— See Advertisement Page 95 —

U. S. STONEWARE CO. 103
Akron, Ohio
Ball and Pebble Mills, Jar Mills, Grinding Jars
Farkas Scales Gomoll
— See Advertisement Page 151 —

V

VELSICOL CHEMICAL CORP. 1808
Chicago, Ill.
Hydrocarbon Resins and Solvents
Technical representatives from all departments.
— See Advertisement Page 111 —

W

C. K. WILLIAMS CO. 1804
Easton, Pa.
Panels Showing Paints Formulated with Various Iron Oxide Pigments, Cuprous Oxide as Mildewcide, Chromium Green Oxides
Alexander Burris Dubbeldeman Frayne
Fuller Green Hathaway Jeffrey
Juley Kroepel Lippincott Love
Mix Murray Rambo Richards
Stuebing Stephens Stewart Thayer
Wells

WITCO CHEMICAL CO. 215-216
New York, N. Y.
Driers, Plasticizers, Carbon Blacks, Surface Active Agents, Stearates, Extender Pigments, Emulsifiers
Gardner Spielman Martorana Armato
Kaszynski Prewitt Barry Hoehler
Freeman
— See Advertisement Page 171 —



RUGGED PROTECTION

MAPICO BLACK

99% PURE SYNTHETIC IRON OXIDE

Permanently exposed structural steel, as in the case of bridges, requires a particularly good paint film. A properly formulated MAPICO® BLACK paint is ideal for this purpose. Its low oil absorption permits a greater percentage of pigment and therefore highly important abrasion resistance. Chemical inertness means less effect from stack gases, acids, and alkalies. Good UV screening means longer life for the paint film. Add to these advantages negligible soluble salt content, lightfastness, high covering power and low cost and you have many good reasons for formulating with MAPICO BLACK. Try it!

A COLUMBIAN COLLOID

MAPICO
PURE OXIDES OF IRON
COLORS

COLUMBIAN CARBON COMPANY
MAPICO COLOR UNIT
380 MADISON AVENUE, NEW YORK 17, N. Y.

YELLOWS • TANS • REDS • BROWNS • BLACK

BRANCH OFFICES AND AGENTS

Akron, Columbian Carbon Co. • **Atlanta,** Chas. L. Burks & Co. • **Boston,** Columbian Carbon Co. • **Chicago,** The Cary Co. • **Dallas,** Roy A. Ribelin Distributing Co. • **Detroit,** Columbian Carbon Co. • **Houston,** Roy A. Ribelin Distributing Co. • **Kansas City, Mo.,** Abner Hood Chemical Co. • **Los Angeles,** Martin, Hoyt & Milne, Inc. • **Louisville,** Wm. B. Tabler Co. • **Minneapolis,** Willard N. Swanson Co. • **New Orleans, La.,** Roy T. Cucullu • **Philadelphia,** Columbian Carbon Co. • **Portland, Ore.,** Martin, Hoyt & Milne, Inc. • **St. Louis,** J. E. Niehaus & Co. • **San Francisco, Seattle,** Martin, Hoyt & Milne, Inc. • **Toronto,** Columbian Carbon Co.



Rain tonight?

Paint today!

Lytron* 680

is stretching the exterior painting season

. . . because this chemically unique acrylic-type polymer latex can form smooth flexible films even when the temperature drops to 40° F.

. . . because these films are water resistant within a very short time after application!

These are facts learned in the laboratory . . . and proved in the field in a series of full scale house exposures. Exterior paints formulated with Lytron 680 have been evaluated for the past two years in 11 areas around the country. In cold climates, hot climates, humid climates, dry climates. On previously painted wood and on masonry. Results: excellent, everywhere!

Lytron 680 films won't rupture on porous substrate. There's no mottling or spotting. Blistering even over green masonry is minimized. Controlled small particle size of Lytron 680 assures proper binding of high volumes of pigment, excellent adhesion over the most difficult surfaces, color retention, stability, resistance to substrate alkalinity.

Lytron 680, now in full commercial use, is immediately available in tankcar quantity. For samples and data, write Monsanto Chemical Company, Plastics Division, Room 1822, Springfield 2, Mass.

MONSANTO

*LYTRON: REG. U. S. PAT. OFF.



how Gelva base paints compare in tests with other types of interior paints

(one of a series)

Using standard test methods and assigned ratings on a scale from 10 to 0—good to poor, a typical GELVA paint formulation compares impressively with commercial paints bought on the open market in the amount of drag noted brushing over a porous surface.

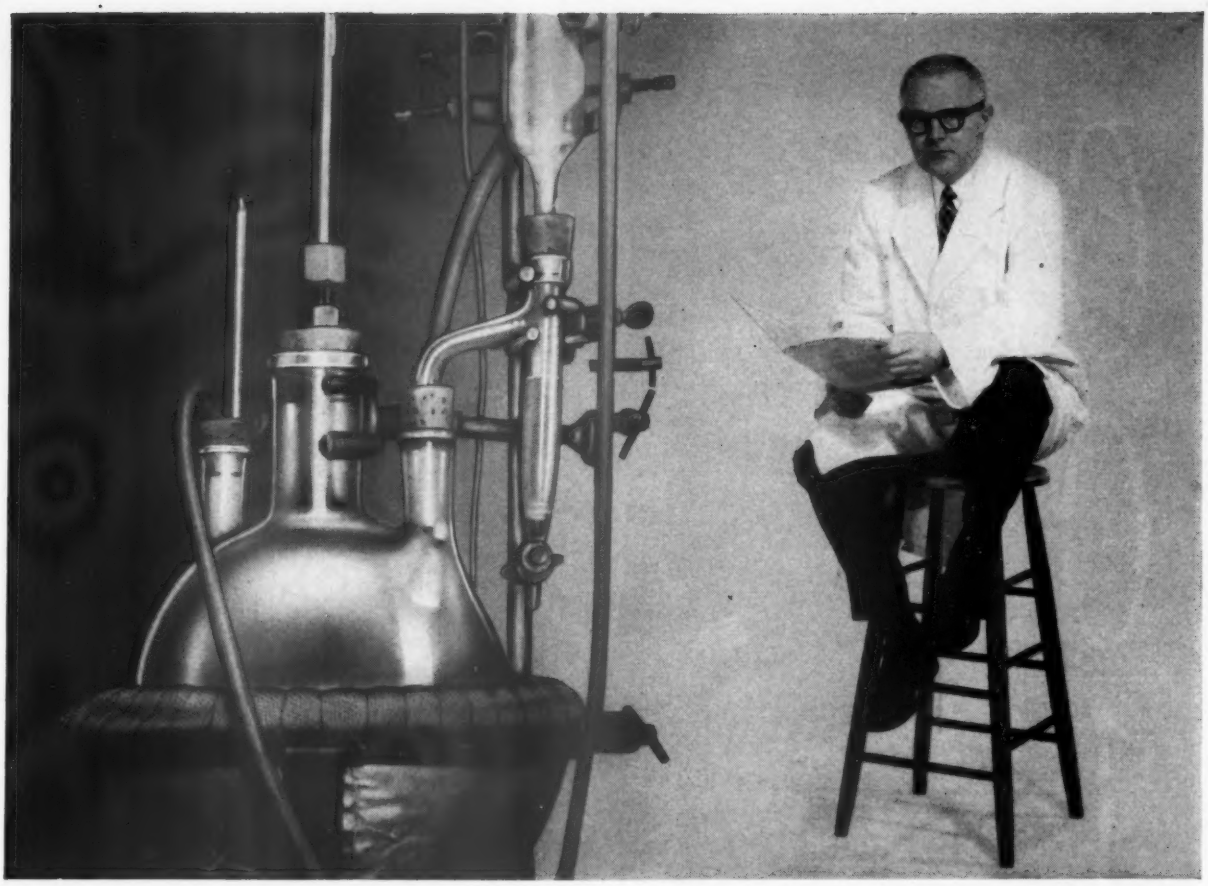
A represents a PVAc base paint
B represents a styrene butadiene base paint
C represents an acrylic base paint
D represents an alkyd base paint
E represents the average of eight paints tested
GELVA 2361 represents a Shawinigan PVAc paint formulation

This is factual evidence of extra value for paint manufacturers who use GELVA emulsions in their paints. Shawinigan's unequalled experience and continuing research are good reasons for specifying GELVA. For formulation data in booklet, "Gelva Emulsions for Paint," write Shawinigan Resins Corporation, Department 2210 Springfield 1, Mass.

SALES OFFICES: ATLANTA CHICAGO LOS ANGELES
NEW YORK SAN FRANCISCO

GELVA® *emulsions for paints*

SHAWINIGAN RESINS



Improve your polymers with CARBIDE'S higher acrylates

LATEX PAINTS—By using low concentrations of 2-ethylhexyl acrylate copolymerized with vinyl acetate, vinyl chloride, or styrene, you can obtain excellent, internally plasticized resins. Also, 2-ethylhexyl acrylate improves low temperature coalescing properties, color retention, and water and alkali resistance.

SPECIALTY RUBBERS—Copolymerize butyl acrylate with acrylonitrile to get hot oil and ozone resistant rubbers useful for tough gasketing applications.

ADHESIVES—Homopolymers of 2-ethylhexyl acrylate are useful as adhesives and bonding agents.

TEXTILE FINISHES—Copolymers of vinyl acetate with higher acrylates are suggested for finishing cottons.

LUBRICATING OILS—Investigate copolymers of higher acrylates for viscosity index improvers and pour point depressants.

Applications don't stop here! A roundup of known and potential uses for the higher acrylates and ethyl acrylate, butyl acrylate and 2-ethylhexyl acrylate are described in—ACRYLIC ESTERS (F-7434)—For a copy write Union Carbide Chemicals Company, Department H, Room 328, 30 East 42nd Street, New York 17, New York.

"Union Carbide" is a registered trade-mark of Union Carbide Corporation.

UNION CARBIDE

CHEMICALS

Union Carbide Chemicals Company
Division of Union Carbide Corporation
30 East 42nd Street, New York 17, N. Y.

In Canada—Carbide Chemicals Company, Division of Union Carbide Canada Limited, Montreal.



PHOTO COURTESY, T. BAUMRITTER CO.

Where Clarity in Lacquers is Vital... Specify Celanese Solvent 601

Lacquer solutions are protected against color build-up during storage

The ability to inhibit color build-up in nitrocellulose lacquers—even after long storage—is but one of the many advantages of Celanese Solvent 601.

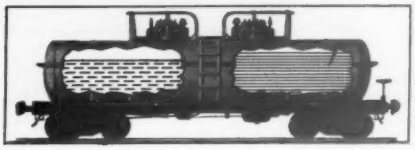
This quality solvent compares in solvent power, evaporation rate and other properties to higher cost methyl ethyl ketone...is offered as a replacement in both vinyl and nitrocellulose formulations.

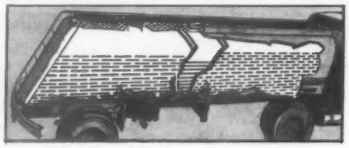
Check with your Celanese representative about the many advantages of Celanese Solvent 601. Write for special literature:

Celanese Corporation of America, Chemical Division, Dept. 558-J, 180 Madison Avenue, New York 16, N. Y.

Celanese®

Get the Economy of Split Shipments. Fill *all* your solvent needs with Celanese compartmented tankcar or tankwagon delivery, and enjoy the advantage of CL prices! Available from district storage points in Newark, Chicago, and Bishop, Texas.





Celanese CHEMICALS

Speakers At 35th Annual Federation Meeting

In Philadelphia, October 30 - November 2



H. E. HILLMAN
Program Chairman



DR. ALBERT C. ZETTLEMOYER
Mattiello Lecture



DR. ROGER H. LUECK
Keynote Address



SIDNEY B. LEVINSON
Spackling Compounds



DR. J. S. LONG
Adhesion and Adhesives



JULIUS E. SPECTOR
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DAVE BOSSE
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CHARLES DELLERMAN
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J. J. HUDSON
Material Handling Panel



THOMAS C. INGRAM
Material Handling Panel



CHESTER OLSON
Material Handling Panel



COL. "BILLY" HOOD
Open Forum Session



W. S. HERNER
Material Handling Panel



JOHN OATES
Pigment Dispersion

NEWS

Dr. Roy H. Kienle Dies; First Mattiello Lecturer

Dr. Roy H. Kienle, director of the research service department of the Stamford laboratories of American Cyanamid Co., died last month in Stamford Hospital. He was 61 years old.



R. H. Kienle

Dr. Kienle had formerly been director of applied research at the company's plant at Bound Brook, N. J., dealing in pigments, dyes, textile finishes and resins. He had been a research chemist with General Electric from 1919 to 1933, working with resins, polymers, coatings and electrical insulations and plastics.

Dr. Kienle was the first Mattiello Lecturer at the Annual Meeting of the Federation of Paint and Varnish Production Clubs in 1949.

He received a B.S. from Worcester Polytechnic Institute in 1916, a master's degree from Union College in 1927 and a Ph.D. in Chemistry from Rutgers University in 1938. He had been an Adjunct Professor at Polytechnic Institute of Brooklyn, and the author of many technical articles on coatings and related materials.

Dr. Kienle had been a member of the American Chemical Society, the Federation of Paint and Varnish Production Clubs and the New York Paint and Varnish Production Club, among others. In 1955 he was the recipient of the New York Club's Annual PaVac Award for outstanding contributions to the protective coatings industry and to the Club.

•

Sales Representative Named

Landers-Segal Color Co. of Brooklyn, N. Y., has announced the appointment of V. J. Blood & Associates of Bladensburg, Md., as sales representative for Maryland, Virginia and the District of Columbia.

DeVilbiss Sets Field Schools

Field training schools for spray equipment are to be established by The DeVilbiss Co., it has been announced. The schools will be run for the benefit of the company's contract automotive jobbers.

Regional field schools are to extend through next year. In three-day sessions, regular instructors from the Toledo school will conduct instruction in the theory, operation, maintenance and servicing of DeVilbiss equipment.

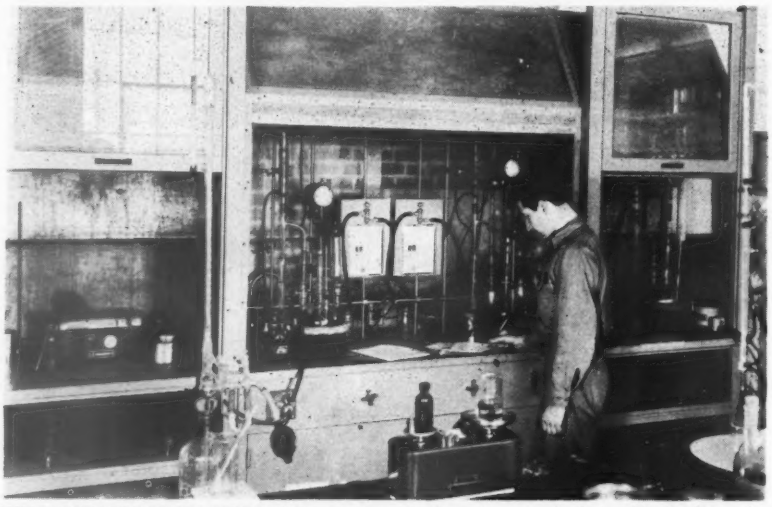
The tentative schedule calls for schools in Cleveland, Atlanta, West Coast, Dallas, St. Louis, Chicago, Newark and Detroit sales divisions between October, 1957, and the summer of 1958.

Form Overseas Department

An international department has been formed by J. M. Huber Corp., it has been announced by Michael W. Huber, president. The new department will be responsible for marketing of carbon blacks, clays, inks, rubber chemicals and pigments, as well as licensing of Huber processes.

The department is headed by Peter Schoenburg, company director of export.

Key personnel in the department are Louis A. Lara, export sales manager, Carlos L. Herman, sales service manager, and Henry H. Graebner, manager of export orders. Fred S. Thornhill continues as technical representative in Paris.



BENJAMIN MOORE'S NEW LAB: A chemical engineer tabulates his findings in a section of the new Benjamin Moore & Co. Central Laboratories at Newark, N. J. The new unit contains research, development, product finishes and control operational units, as well as a large technical library and pilot plant.

Construction Confab Slated

Creative trends in structural design will be the theme of the third annual National Construction Industry Conference scheduled for December 4 and 5 at the Congress Hotel in Chicago.

The conference is sponsored by the Armour Research Foundation of the Illinois Institute of Technology.

Four half-day sessions will be devoted to consideration of the form, materials, methods and applications aspects of structural design, according to conference chairman Robert L. Janes, assistant manager of the Foundation's mechanical engineering research department.

Pfizer Acquires N. C. Firm

Chas. Pfizer & Co., Inc., has acquired the Morton-Withers Chemical Co. of Greensboro, N. C., it has been announced by Joseph R. Morton, president of Morton-Withers, and John E. McKeen, president of Pfizer.

The North Carolina firm will be operated as a subsidiary of Pfizer with no changes planned in management or personnel. Mr. Morton will continue as president, and John P. Withers remains as vice president.

The firm produces chemical specialties for the petroleum, rubber and plastics industries. Among its products are vinyl plasticizers and polyester resins.

NEWS

New York Club Blasts Unauthorized Name Use

The Executive Committee of The New York Paint and Varnish Production Club has acted against unauthorized use of the New York group's name and commercialization of its technical developments.

The Committee stated recently that it has been "deeply concerned" at the unauthorized use of the club's name by companies and individuals. It went on to say that it is "disturbed" by the commercialization of technical developments by "outside interests."

The Committee has adopted the following policies:

"The name, 'The New York Paint and Varnish Production Club,' as well as the Club reports and technical papers, are the property of The New York Paint and Varnish Production Club. Expressed or implied use of the Club's name to endorse principles, products or processes is prohibited. This stipulation may not be waived except by written authorization of the Executive Committee."

The following paragraph is to appear on all published technical reports:

"The work described herein is published as a public service to the paint and varnish industry. The New York Paint and Varnish Production Club does not indorse in any way the commercialization of any of its projects by outside interests and further makes no representation as to the accuracy of its reports."

•

Solvay Ups Production

Solvay Process Division of Allied Chemical & Dye Corp. will more than double the capacity of its vinyl chloride monomer operation, according to an announcement by I. H. Munro, president of the division.

The division's plant at Moundsville, W. Va., will be enlarged to facilitate increased production resulting from heavy demands for consumer products made from vinyl plastics, Mr. Munro said.



ANNIVERSARY AWARD: Allin W. Vallentyne (left) presents an antique silve, tray to Edward M. Toby, Jr., president of American Mineral Spirits Co., during a dinner at the 21 Club in New York commemorating Mr. Toby's 25th Anniversary. Mr. Toby has been Amsco's president since 1947.

Publicity Committee

An advisory Public Relations Committee of the Federation of Paint and Varnish Production Clubs has been publicizing the 1957 Mattiello Lecture by Dr. Albert C. Zettlemoyer and the Keynote Address of the 1957 Annual Meeting of the Federation by Dr. Roger H. Lueck.

Dr. Zettlemoyer is director of research at the National Printing Ink Research Institute, and Professor of Chemistry at Lehigh University. Dr. Lueck is vice president of research for the American Can Co.

Members of the publicity committee organized by W. E. Santoro, chairman of the 1957 Mattiello Lecture Committee, were:

H. G. Brown, Jr., E. I. du Pont de Nemours & Co. public relations; C. Carsters, Interchemical Corp.; Dr. H. L. Gerhart, Pittsburgh Plate Glass Co.; C. H. Flynn, Federation executive secretary; F. Borrelle, managing editor, *Official Digest*, and W. J. Greco, Socony Paint Co.

Other members of the committee were: C. Rose, National Lead Co.; D. Forrestal, Monsanto Chemical Co.; P. Felton, Dow Chemical Co.; S. Hoagland, Interchemical Co., and C. H. Lange, Sherwin-Williams Co.

Fuller Expands to Mexico

House paints and consumer products are to be manufactured in Mexico by W. P. Fuller & Co., it has been announced.

The firm has purchased the paint factory of Hart & Burns de Mexico in Ensenada, and has organized its latest foreign enterprise, W. P. Fuller & Co. de Mexico, S.A.

The new organization is supported by both American and Mexican capital. Wulfrano Ruiz, one of Mexico's leading industrialists and civic leaders, will serve as president and treasurer of the company. His brother, Humberto Ruiz, will act as vice president and secretary. Both are major stockholders.

General sales manager for the new company will be Joseph M. Bonavito. Manuel Gutierrez, formerly with Celotex and Hart & Burns de Mexico, will serve as production manager.

•

New Agent Appointed

Southern Clays, Inc., has announced the appointment of Charles A. Wagner Co., Inc., 4455 North Sixth St., Philadelphia, Pa., as exclusive agent in the greater Philadelphia and Baltimore areas.

Southern Clays manufactures hydrous and anhydrous clays.

NEWS

Titanium Pigment Plant On Stream In Canada

The official opening of Canada's first titanium pigment plant has been announced by National Lead Co.

The plant, located at Varennes, Quebec, approximately 15 miles northeast of Montreal, has already begun full-scale production.

Joseph A. Martino, president of National Lead and chairman of the board of Canadian Titanium Pigments, Ltd., National Lead subsidiary which operates the plant, said that the new facility will make Canada virtually self-sufficient in titanium pigments.

The new plant occupies 76 acres within an industrial center in Varennes. Titanium slag, basic raw material, comes from Sorel, Quebec, 40 miles down the St. Lawrence River. The plant has been constructed at a cost of approximately $15 million, and employs approximately 300 people.

Entire output of the plant will go to Canadian industry.

A large sulfuric acid plant, using the modern contact process, forms part of the project at Varennes. The total output of the acid plant will be consumed in pigment production.

California Leads Building

California, New York and Illinois, in that order, were the leading states in construction contracts during the first half of 1957, according to a report by F. W. Dodge Corp., construction news and marketing specialists.

California, with $2,185,000,000 in contracts, ranked first in heavy engineering and residential building, and second in non-residential building. New York ranked first in non-residential building and second in the other two major categories, with contracts totaling $1,683,000,000.

According to the report, the national average gain was five per cent over totals recorded during the same period of 1956. Residential building was the principal soft spot in construction so far this year, the report said.

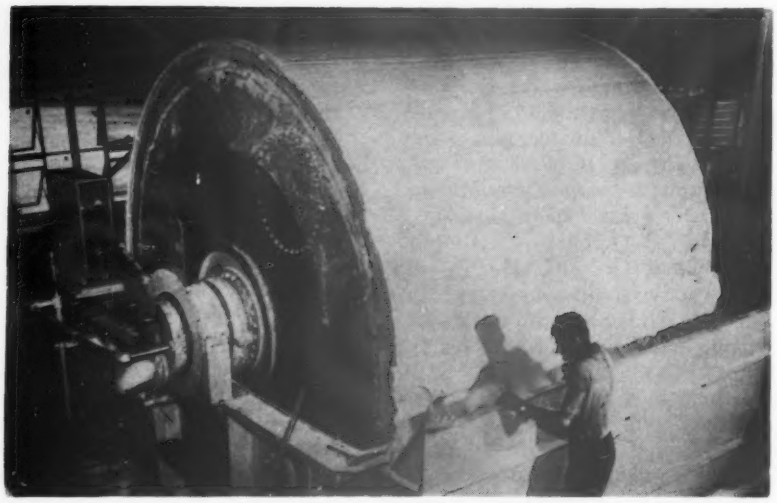
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Arnstein, Farber Head Drive

Lester Arnstein, Arnesto Paint Co., Inc., and Benjamin Farber, Farnow Varnish Works, head the Paint and Chemical Division of Joint Defense Appeal for 1957.

A dinner last month at the Hotel Warwick in New York highlighted the drive to help JDA raise the national total of $5,600,000 in behalf of its constituent agencies, the American Jewish Committee and the Anti-Defamation League of B'nai B'rith.

Mr. Arnstein was 1956 chairman of JDA's Paint and Chemical Division, and Mr. Farber was an associate chairman.



Dewatering of titanium pigment in this drum filter precedes processing in rotary kiln, where titanium hydrate is converted into titanium dioxide at Canada's first titanium pigment plant opened recently by a National Lead Co. subsidiary.

Vinyl Known to Most Americans, Survey Shows

A majority of adult Americans (61%) recognize the word "vinyl," and 51 per cent can name at least one product made of it, according to a survey conducted for Dewey and Almy Chemical Co. by Audience Research, Inc., recently.

The poll of a cross section of 1625 adults in 155 areas was conducted to determine whether the world "vinyl" would be an asset when stressed in vinyl paint promotions.

More than one-third of those polled (37%) were able to recall such special vinyl qualities as durability, ease of cleaning and flexibility. In contrast, only 18 per cent said they had heard of acrylic or alkyd, and less than half of those were able to mention products or characteristics.

Latex, a broad term used to describe a wide range of water-thinned paints, including vinyls and acrylics, drew 70 per cent recognition and strong association with rubber products, durability and elasticity.

The survey revealed that few people associate paint with vinyl. Chief among the products associated with vinyl were floor coverings and plastics in general.

Audience Research is a member of the Gallup organization.

•

New Film by National Starch

A 16 mm sound and color motion picture titled, "The Modern Touch," has been produced by the resin division of National Starch Products, Inc., and is being made available to paint manufacturers for showings before architectural, decorator, industrial and technical groups.

The film demonstrates how vinyl copolymer based paints, when formulated specifically for interior or exterior applications, can be easily applied to provide durable and colorful protection in both industrial and home installations.

The film has a running time of 15 minutes, and presents vinyl paint applications at outdoor and indoor locations. The film demonstrates such characteristics as color retention, ease of application, resistance to grease and alkalies and ability to withstand repeated washings.

CONTINENTAL'S EXCLUSIVE







Made with an inward curl, former multiple friction ring paint cans left an edge of raw metal inside the can. If corrosion started here, it might undercut interior enamel and result in rust.



The Outward Curl in the Tripletite ring still has an edge of raw metal. But this raw edge is now outside the can. There is no chance of exposed steel touching your polyvinyl acetate or latex base paints.

Tests prove your PVA and latex base paints get six to nine months longer shelf life with Continental's Outward Curl Can.

Made with the Tripletite friction ring curled outward, the Outward Curl Can gets complete inside enameling. Raw metal can't touch your paint. On top of all this, Continental's Tripletite lid provides 50% increase in guard points against oxidation and messy paint skin.

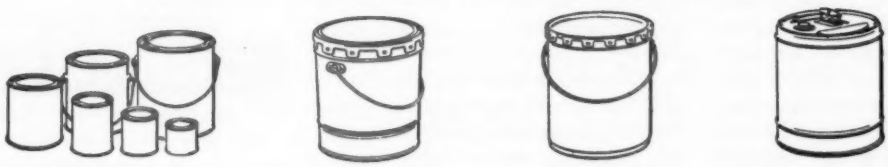
Don't wait to put Continental's Outward Curl Can to work for you. Along with the best in paint cans—we make available a full range of engineering and research services. On-the-nose delivery from seven points across the U. S.

QUALITY Continental SERVICE

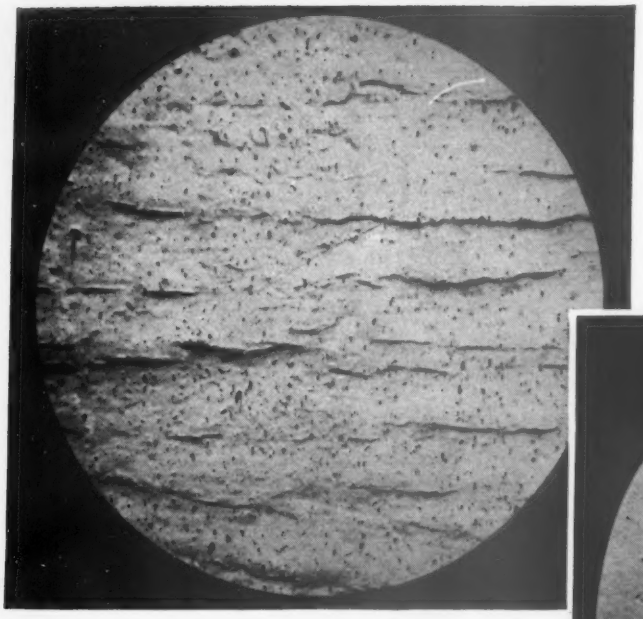
CONTINENTAL CAN COMPANY

Eastern Division: 100 E. 42nd St., New York 17
Central Division: 135 So. La Salle St., Chicago 3
Pacific Division: Russ Building, San Francisco 4

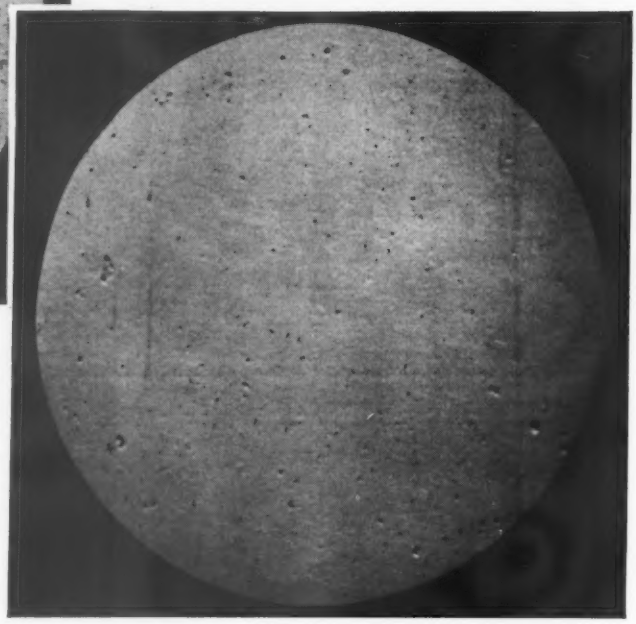
Let Continental fill all your paint packaging needs



TRIPLETITE CANS • FLARING PAILS • LUG-COVER PAILS • CLOSED-HEAD DRUMS



Without BENTONE 34 Gellant ▲



with BENTONE 34 Gellant ▶

Outdoor tests prove dry film properties of paints are improved two ways with "DUTCH BOY" BENTONE gelling agents

Laboratory tests and accumulated field data are proving that "Dutch Boy" BENTONE® gelling agents are as beneficial to dry as to wet paint films. Two outstanding effects have been noted.

Film thickness is more uniform . . . paint performance more predictable

Measurements of dry film thicknesses show paints containing BENTONE gelling agents go on more evenly, behave more predictably . . . despite normal processing and application variables. And once you have the desired uniform paint characteristics, you can reproduce them time after time.

Film properties are better . . . paint performance superior

Outdoor exposure tests show also these "Dutch Boy" gellants *improve* dry film properties.

In the micrographs above, for example, you see how BENTONE **34** prevents checking in a test paint exposed at 45° South for 5 months.

Other tests show that BENTONE gelling agents strongly reinforce the film, increase water resistance, aid chalking control, step up stability, boost scrub resistance. All without adversely affecting adhesion.

The versatile "Dutch Boy" BENTONE gelling agents . . . **18-C, 34,** and **38** — confer many other benefits on many other paints. For handbooks, for technical assistance, just write.

Dutch Boy® CHEMICALS

NATIONAL LEAD COMPANY
111 Broadway, New York 6, N.Y.
In Canada: CANADIAN TITANIUM PIGMENTS LIMITED
630 Dorchester Street, West, Montreal



LOOK AT THESE VERSATILE OIL-SOLUBLE SURFACE-ACTIVE AGENTS

Every day the ALKATERGES® are being utilized in new industrial applications. A close look at these versatile surface-active agents may suggest additional ways they can be profitably used to help you solve a particular problem. Samples of ALKATERGES C, A, E and T are available, as well as helpful technical data sheets. Write for yours today.

LOOK INTO THESE USES

EMULSION STABILIZERS In oil-in-water emulsions, ALKATERGES and their soaps are effective as emulsion stabilizers or auxiliary emulsifying agents. They aid in the dispersion of insoluble calcium and magnesium soaps.

PENETRANTS Solutions of the salts of ALKATERGES are useful as penetrants in textile and paper manufacturing. Reported to reduce resin consumption in waterproofing paper.

PIGMENT-GRINDING ASSISTANTS; PIGMENT DISPERSANTS ALKATERGES convert stiff pigment-oil mixtures into fluid, easy-to-grind compositions. Also recommended in resin-carbon black formulations.

CORROSION PREVENTION By neutralizing perspiration acids, the ALKATERGES protect metals subject to corrosion through handling. Industrial users confirm the exceptional qualities of Alkaterge-T as an oil-soluble corrosion inhibitor. Manufacturers of rust preventative oils, lubricants, cutting oils, corrosion resistant greases and extruding oils will find evaluation profitable.

DISPERSING AGENTS ALKATERGES are recommended as dispersants for flattening agents in varnishes and enamels and for any finely-divided solid in nonpolar liquids.

ACID ACCEPTORS Since most of their salts are somewhat oil soluble, ALKATERGES can be used to tie up acidity from deterioration of oils or additives. Useful also as perspiration acid neutralizers in corrosion-preventive oils.

ANTI-FOAMING AGENTS Used alone or in carriers, ALKATERGES control certain foams encountered in processing organic materials such as manufacturing antibiotics. They do not turn rancid and, in the concentration normally used, they are nontoxic to most antibiotic microorganisms. Tests indicate that Alkaterge-A is useful as an anti-foam agent in non-aqueous systems.

Write for complete information and samples.

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ASBESTINE 325

64 YEARS of production have paid off for International Talc Co. and its customers. As the world's largest producer of magnesium silicate, International Talc Co. announces the availability of their newest member to the family. . . . Asbestine - 325

★ THIS NEW PRODUCT FEATURES

Good dispersion with minimum use of oil needed in grinding. . . . enables formulating at higher pigment volume concentrations. Thereby. . . .

REDUCING RAW MATERIAL COSTS

without affecting performance of storage characteristics.

Also available in other grades. . . .featuring these advantages

1. Available in low, medium and high oil absorption
2. Pure white — suitable for white or colored paints
3. Acicular structure affords good suspension
4. Mixes readily in all paint vehicles
5. Contributes to greater durability in exterior paints
6. Excellent flatting agent for flat or semigloss coatings
7. Uniformly low moisture content (less than .5% loss at 212°F.)
8. Bulking value 4.2 gallons per 100 lbs.
9. Packed in 50 lb. paper sacks for your convenience

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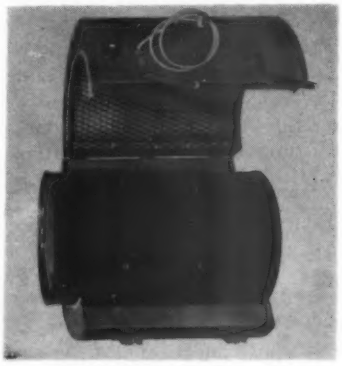
ASBESTINE 325

S. W. Tuttle, Vice-President

NEW MATERIALS & EQUIPMENT

A MONTHLY MARKET SURVEY

This section is intended to keep our readers informed of new materials and equipment. While every effort is made to include only reputable products, their presence here does not constitute an official endorsement.



PALMER

DRUM WARMERS
In Four Sizes

Palmer drum warmers now available in 14, 16, 30 and 55-gallon drum sizes. All models have automatic temperature control in choice of two ranges: from 100 to 450°F., or from 60 to 250°F.

Two smaller sizes come in 1500 watts, 115 volt capacity only, while two larger sizes are furnished in 1500 watts, 115 volts, or 3200 watts for all voltages and phases from 208 volts up to 550 volts, three phases.

Well-insulated hinged halves fit around drum with a flexible top gasket allowing for variations in drum diameters, yet assuring snug fit and preventing heat loss. Warmers said to be adaptable to almost any type of drum warming. Can also be used in combination with mechanical agitators.

The Harold L. Palmer Co., Dept. PVP, 2980 W. Davidson Ave., Detroit 38, Mich.

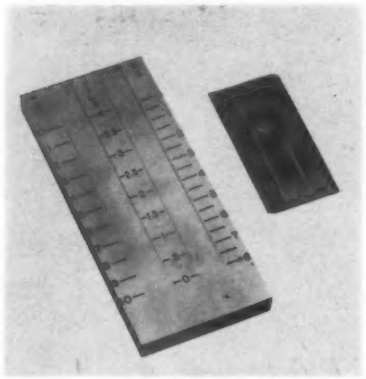
PHENOLIC RESIN
Light Color

A light-colored phenolic resin has been developed for use in surface coatings, said to demonstrate superior resistance to alkalis and acids and lower cost when compared to conventional phenolic resins.

Products utilizing Resin #3725 can be pigmented to a wide range of hues because of light color. Long storage does not affect stability or drying time, according to manufacturer.

Product is based on a modified phenol, and supply is said not to be subject to frequent shortages experienced in production of phenols based on by products. Resin #3725 is a non-heat-reactive oil-soluble resin.

Barrett Division, Allied Chemical & Dye Corp., Dept. PVP, 40 Rector St., New York 6, N. Y.



SCHOENY

PAINT GRIND GAUGE
Contains Three Scales

Paint grind checking gauge consists of engraved stainless steel gauge block and wiper. Both said to be precision ground to fine tolerances.

To check grind of paint, small quantity is placed in deep vertical grooves of gauge block. Wiper is moved across gauge block, wiping paint from deep end of grooves to shallow end. Fineness of grind is determined by reading one of three engraved scales on gauge block.

Three scales are: Pacific Coast Standard, Mills and National Standard. Available from Schoeny Tool Co., Dept. PVP, 7407 Havenhurst, Van Nuys, Calif.

DISPERSING AGENT
Stability Over Wide pH Range

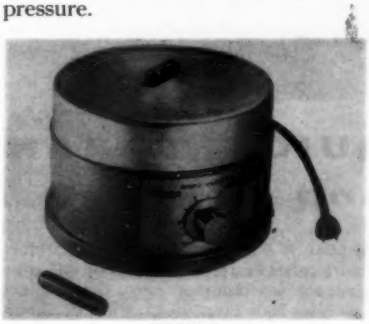
Clear, colorless dispersing agent called "Daxad 30" has been introduced. Said to have minimum foaming tendencies and low viscosity.

Product is also said to be particularly effective for dispersing pigments in water systems and for use where freedom from eventual discoloration is important. Stability over a wide pH range is claimed, and small amounts are said to produce fluid pigment dispersions.

Immediate shipments in commercial quantities. Dewey and Almy Chemical Co., Dept. PVP, 62 Whittemore Ave., Cambridge 40, Mass.

MAGNETIC STIRRER
Handles up to 3 Gallons

Magnetic stirrer has been developed to handle liquids of wide viscosity range in quantities up to three gallons. Any glass, porcelain, nonmagnetic metal or plastic vessel may be used, open or closed, or sealed under vacuum or pressure.



FISHER

Instrument utilizes magnetic lines of force, eliminating contaminant-collecting shaft and impellers of mechanical stirrers and permitting full access to top of container.

Unit said to be wobble-proof. Body is anodized aluminum. Uses 115-volt 50/60-cycle a-c. Available from Fisher Scientific Co., Dept. PVP, 384 Fisher Building, Pittsburgh 19, Pa.

NEW MATERIALS — EQUIPMENT

HIGH-SHEAR VISCOMETER
Rotational Type

Rotational type high-shear viscometer has been developed to evaluate brushability of paints.

Viscometer consists of cylindrical cup in which is suspended a closely fitting cylindrical bob. Small uniform clearance of approximately four mils between rotor and stator surfaces is maintained by flexible suspension device consisting of a pair of universal joints.

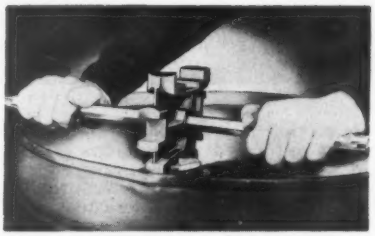
Driving weight to produce force necessary to overcome drag created by paint sample between two surfaces is measure of ease of brushing. Two wells included in walls of cylindrical cup produce discontinuity approximating that to be found between bristles when brush strokes are produced by hand. Cup is water-jacketed and connected to circulating water bath to maintain constant temperature of 77°F.

Gardner Laboratory, Inc., Dept. PVP, Bethesda 14, Md.

STEEL DRUM WRENCH
For Many Types of Fittings

"All-Plug" wrench is said to service more than 100 kinds and sizes of American or foreign plugs, bungs or fittings on steel drums.

Construction is such that runner bands or chimes of drums do not interfere with workman's knuckles. Small drain plugs may be spun in or out with sockets at each end of slide bar. Workhead may be positioned at center of bar, or at either end for greater leverage.



SCHINKER

Constructed of 4½" diameter four-pronged steel workhead fitted to 5/8" x 18" hexagon steel slide bar. Weighs three and one half pounds. Available with spark-proof bronze workhead or bronze workhead with bronze slide bar.

Michael A. Schinker Mfg. Co., Dept. PVP, 6514 S. Western Ave., Chicago 36, Ill.

SELF-SANITIZING ADDITIVE
Fights Fungi and Bacteria

Self-sanitizing paint additive said to have long-lasting killing action against both fungi and common disease-producing bacteria has been introduced.

Called "Nuozene," additive is said to be effective in most types of paint formulations, lasting for the life of the paint, and requiring no special precautions in handling. Product is a complex organic chemical compound of the triazine family.

Nuodex Products Co., Dept. PVP, Elizabeth, N. J.

BLUE TONER
Phthalocyanine Type

Phthalocyanine Bahama Blue BA-4561 is full-strength toner which is non-flocculating in a wide range of air-dry enamels, industrial baking enamels and lacquers. Is also non-crystallizing.

Material claimed to be superior in flocculation resistance not only to previous toners, but also to specially resinated blues and extended materials heretofore offered for that purpose. Material has advantage of eliminating extenders which may cause undesirable physical changes in enamel or lacquer formulations.

Also claimed is unusually soft texture for a phthalocyanine blue toner. Said to reach full strength



QUICK, CLEAN, SAFE FILLING and SEALING... at lowest cost

AMBROSE PF-9 Filling and Sealing Machines require only 15 minutes for clean up and color change or for changing sizes. Capacity per minute is: Half Pints 30-35; Pints or Quarts 25-30; Half Gallons 18-20; Gallons 16-18.

AMBROSE PF-9's are PORTABLE. You can adapt them to your production-line-filling or move them like Minute Men to any special filling area.

AMBROSE PF-9's are SAFE because they are *air* operated—no gears—no motors—no metal-to-metal contact. Versatile PF-9's handle all types . . . water base, oil base, varnishes or lacquers.

Your operators will *praise* AMBROSE PF-9's because they work with a man and *for* him. Regardless of whether cans are fed automatically, or through a trip-feed, PF-9's make friends of the man on the job. Your men will like the patented no-drip nozzles that assure *clean* packages. Your Cost-Accountant will like the *accurate fill*—the saving in time—materials and labor. (You need only one man on a PF-9)

Write today for complete information. No obligation, of course.

C. M. AMBROSE CO.

YOU GET THE BIG PLUS IN A BORDEN EMULSION

Polyco 2719 Acrylic gives you IMPROVED LEVELING

POLYCO 2719 is Borden's new 100% acrylic copolymer emulsion for all types of acrylic based paints. This emulsion forms extremely flexible, weather- and water-resistant films and, in paints, gives improved leveling over conventional acrylic emulsions. It offers remarkable color retention and adhesion to a wide variety of exterior and interior surfaces. Paints formulated with POLYCO 2719 are easy to use, fast drying and give unusual resistance to scrubbing, scuffing and out of the ordinary surface abuse.

Polyco 807 Butadiene Styrene gives you LOW ODOR

POLYCO 807 is a new, improved, low odor emulsion for all conventional butadiene styrene paints. 33% butadiene and 67% styrene, the films cast from this emulsion are flexible, water white and highly resistant to yellowing or discoloration. POLYCO 807 has high alkyd compatibility and will withstand a minimum of 6 freeze-thaw cycles when properly compounded. Paints formulated with this emulsion give excellent adhesion to many surfaces and also display outstanding wet-scrub resistance.

Borden's Polyco 804 Polyvinyl Acetate gives you IMPROVED PIGMENT WETTING

POLYCO 804 is a true vinyl acetate copolymer, exhibiting extremely fine particle size, borax stability and excellent water resistance. Paints formulated with this emulsion offer freedom from foam under brush or roller application. Films remain tack-free and flexible indefinitely on exposure or weathering. POLYCO 804 films are clear, bright, colorless, nonoxidizing and heat-resistant. They give fine adherence to a wide range of surfaces and have outstanding water and scrub resistance.



Prove it to yourself by testing a POLYCO sample at your own plant!

Mail coupon for working sample and complete technical data or write today for a Borden technical expert to visit you in your plant soon.

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IT'S GOT TO BE GOOD!

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The Borden Company
Chemical Division
350 Madison Avenue, New York 17, N. Y.

Please send working sample and technical data on POLYCO 804 ☐
POLYCO 807 ☐ POLYCO 2719 ☐

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

development with considerably less grinding than required by other toners.

Standard Ultramarine & Color Co., Dept. PVP, Huntington, W. Va.

ALKYD EMULSION
For Water-Thinned Gloss Paints

An alkyd emulsion designated 1505 Synthemul, is said to offer better adhesion, better water resistance and greater mar resistance than other water-thinned gloss architectural finish vehicles.

Properties approximating those of solvent-thinned gloss paints are claimed to be made possible.

Coatings containing the emulsion are said to have same advantages of other emulsion paints. They are self-priming, maintain a uniform gloss over surfaces of varying porosity, set to touch in 30 minutes and dry tack-free overnight. Coverage and brushing qualities are said to be excellent.

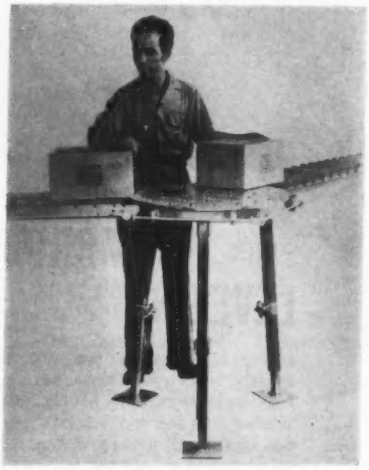
1505 Synthemul may be used by itself or, for improved color retention and speed of dry, may be used in combination with vinyl acetate emulsions. Good gloss said to be obtained with pigment volume concentrations of 16 to 27 per cent.

Reichhold Chemicals, Inc., Dept. PVP, RCI Building, White Plains, N. Y.



TABLE TRANSFER STAND
Gravity Conveyor Junction

"Traffic Circle" ball table transfer stand has been developed for use as junction for two, three or four gravity conveyor lines. Said to permit easy routing of objects from one line to any of others.



M-H STANDARD

Also said to be useful where desired to cover a broad area by shifting a gravity conveyor, acting as a variable angle gravity curve. Consists essentially of circular ball table caster on three adjustable legs. Four support brackets accommodate gravity conveyors up to 18 inches wide.

Model for outdoor use or where equipment must be washed or steam cleaned contains nylon seated ball casters with all metal parts zinc coated. M-H Standard Corp., Dept. PVP, 513-521 Communipaw Ave., Jersey City 4, N. J.

PAINT ADDITIVE
Protects Against Freezing

Small quantities of new chemical are said to protect paints against freezing temperatures.

Armeen SZ, a formulated alkaline metal salt of N-coco beta amino butyric acid, is said to be effective with both oil-modified and oil-free paints. In former, stabilization is said to be obtained with as little as 0.32 per cent of the chemical based on a finished paint containing 12 per cent latex solids. Slightly higher concentration recommended for oil-free latex paints.

Available in commercial quantities, stabilizer is effective through a minimum of four freezes at



A new phenolic coating resin

PLASKON® 3725

offers you all these advantages...

Improved Chemical Resistance
Effectively resists salts, alkalis, acids

Superior Weatherability
Up to *three times* the durability of ordinary marine varnishes

Excellent Abrasion Resistance
For longer service life

Greater Flexibility

Excellent Adhesion

Light, Uniform Color

LOWER COST

Promising applications:
Can Coatings • Marine Spar Varnishes and Enamels • Heavy Duty Maintenance Finishes • Porch Enamels • Tank Car Enamels • Floor, Furniture and Plywood Varnishes • Aluminum Paints

For Complete Specifications. Evaluation of PLASKON 3725 for use in these paint products is under way. Information on test data and resin samples are available. For further information address Barrett Division, Allied Chemical & Dye Corporation, 40 Rector Street, New York 6, N. Y.

Visit our booth—No. 1811-1813—at the Paint Show.

Barrett PLASKON®

minus 10°F. with no detrimental effect on scrubability of dried paint film. Also contains bactericidal qualities useful in formulations containing protein materials.

Armour & Co. Chemical Division, Dept. PVP, 1355 W. 31st St., Chicago 9, Ill.

DRUM HANDLING
Automatic Mechanical System

Eight drum handling attachments requiring no hydraulic systems are now in production.

V-1 Vert-O-Matic handles one 30 or 55-gallon drum, while the V-2 model handles two drums. Both are attached to apron of lift truck. The V-2-V handles two drums, one atop the other, the V-S-AS handles two 55-gallon drums and spots one at a time, and the V-3-SS handles three 55-gallon drums, spotting one at a time.

The V-1-DF is a detachable foot permitting the handling of smooth metal and fibre drums which have no heavy beads or rolling hoops. An unusual feature of the V-1-F and the V-2-F, which handle one and two 30 or 55-gallon drums respectively, is that they may be used for intermittent handling of drums, as they easily slip on or off the end of the regular forks of the lift truck.

Little Giant Products, Inc., Dept. PVP, 1530-55 N. E. Adams St., Peoria, Ill.



LITTLE GIANT

SYNTHETIC RESIN
Chemically Neutral

Piccoflex is newest addition to line of synthetic resins. Available in three grades in solid form.

Properties include: chemical neutrality; resistance to kerosene, gasoline, mineral and vegetable oils, water, acid and alkalies; toughness; pigment wetting, and color stability.

Now also being supplied as fifty per cent solution in HiSolv Spirits, which is said to eliminate need for inventory of additional raw materials, simplify handling, reduce labor costs and accelerate processing time.

Among applications suggested are: traffic and exterior masonry paints, overprint varnishes and greaseproofing finish or cardboard by spray.

Pennsylvania Industrial Chemical Corp., Dept. PVP, Clairton, Pa.

GRAVITY TRANSMITTER
For Continuous Measurement

Differential converter transmitter with range continuously adjustable from 0-5 to 0-25 inches of water, is adaptable to continuous measurement and control of specific gravity of liquids in open vessels.

Instrument may be used in several methods of measurement which have been found satisfactory.

Minneapolis-Honeywell Regulator Co., Industrial Division, Dept. PVP, Wayne and Windrim Aves., Philadelphia 44, Pa.

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FREE FLOWING GLASS BEADS





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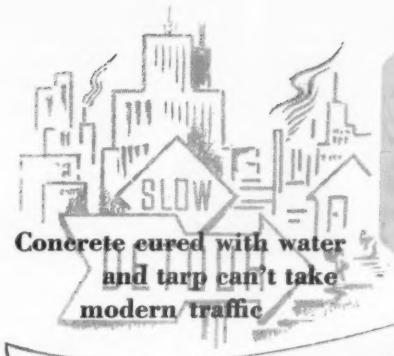
1. Marked resistance to high humidity
2. Flow freely through dispensing equipment
3. Store for unlimited periods without agglomerating
4. Contain no injurious waxes, oils, resins or silicones
5. Offer perfect adhesion to any suitable traffic bead binder

Solve your reflectorizing problems with new Flex-O-Lite Free Flow Glass Beads. Proof of their superior qualities is evidenced by consistent use in several states and in many cities throughout the nation. A trial order will convince you of their high quality . . . superiority born of the "know how" and facilities of the country's dominant producer of reflective glass beads.

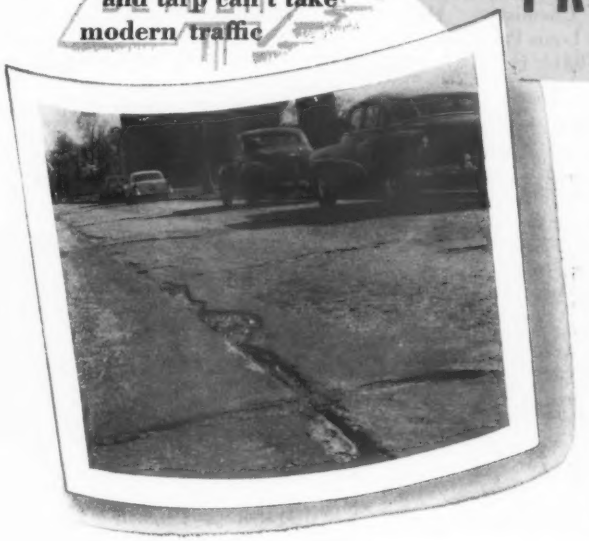
The result of five years of research and development. Field tested for two years with the cooperation of highway and traffic engineers . . . your assurance of satisfaction.

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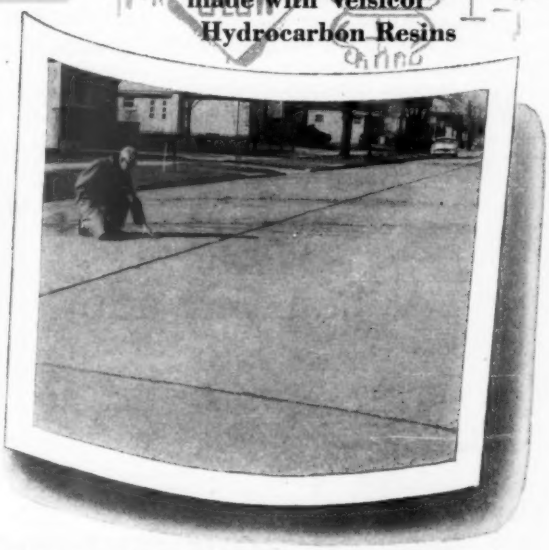
Which picture shows a PROFIT?



Concrete cured with water and tarp can't take modern traffic



New road construction has created a booming market for concrete curing compounds made with Velsicol Hydrocarbon Resins



The nation's accelerated highway program and increased architectural uses of concrete have opened rich new markets for membrane curing compounds made with Velsicol Hydrocarbon Resins. These compounds form moisture-proof "skins" that retard evaporation of water from freshly poured concrete, making it set with greater hardness, reducing dusting and shrinkage, and eliminating surface checking. Let Velsicol show you how to enter or increase your share of this booming market with suggested formulations meeting the U.S. Army Corps of Engineers, specification CRD-C 300-55 and proven superior in actual use. Send for Velsicol's Membrane Curing Compound Bulletin —and your Velsicol representative—today! No cost or obligation, of course.

***VELSICOL HYDROCARBON RESINS** . . . for membrane curing compounds — better film forming qualities, dried films are hard, neutral, more resistant to water permeability, durability of resins is not affected by the alkalinity of concrete.*



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☐ Please have a salesman call to discuss your concrete curing compounds.

☐ Please send technical literature.

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COMPANY_____

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"THE REAL NEWS AT THE PAINT INDUSTRY'S SHOW IS IN BOOTH 1808"

PERSONNEL CHANGES

P. D. GEORGE CO.

Alexander Kitun has been appointed manager of the firm's newly established synthetic resin division, it has been announced.

Mr. Kitun recently resigned as vice president and technical director of the Price Varnish Co. He had previously been department head of the alkyd and resin group of U. S. Industrial Chemical Co.'s resin division.

He is a graduate of Brooklyn College and a past president of the St. Louis Paint and Varnish Production Club.

Charles H. Dart has been appointed operations manager of the firm's newly-established synthetic resin division, it has been announced.

Mr. Dart had previously been plant superintendent of the Price Varnish Co. for 11 years. Prior to that he had charge of synthetic resin production for U. S. Industrial Chemicals Corp., and had been employed in a similar capacity by E. I. du Pont de Nemours & Co.

He is a graduate of Geneva College with a B.S. in Chemistry. He is treasurer of the St Louis Paint and Varnish Production Club.

CONTINENTAL CAN

George Henschel has joined the firm as assistant to the general manager of sales, metal division, it has been announced. He has had more than 25 years of experience in the can industry.

HEYDEN NEWPORT

Ernest E. Holdman has been named vice president and general manager of Heyden Newport International, a newly-formed division of the parent organization, it has been announced.



E. E. Holdman

Mr. Holdman has been associated with Newport Industries, Inc., since 1914. He was appointed vice president in charge of export sales in 1954. He is a pioneer in export marketing of wood naval stores.

Clement H. Horst has become assistant vice president in charge of naval stores products for export. He joined the firm in 1935 as assistant to Mr. Holdman.



R. H. Boggs



C. H. Horst

Richard H. Boggs has been appointed sales manager of chemicals for export. He had previously been export sales manager of Heyden Chemical Corp., and assistant to the director of overseas operations of Nuodex Products Co., a division of Heyden.

T. H. Risch has been appointed manager of the New York territory, it has also been announced. He has been with the firm since 1947, beginning as a salesman in the Chicago territory, and becoming branch manager of the Cincinnati territory in 1953.

S. N. Neader has been named to succeed Mr. Risch as branch manager of the Cincinnati territory. He had been a member of the Chicago branch sales force since 1952.

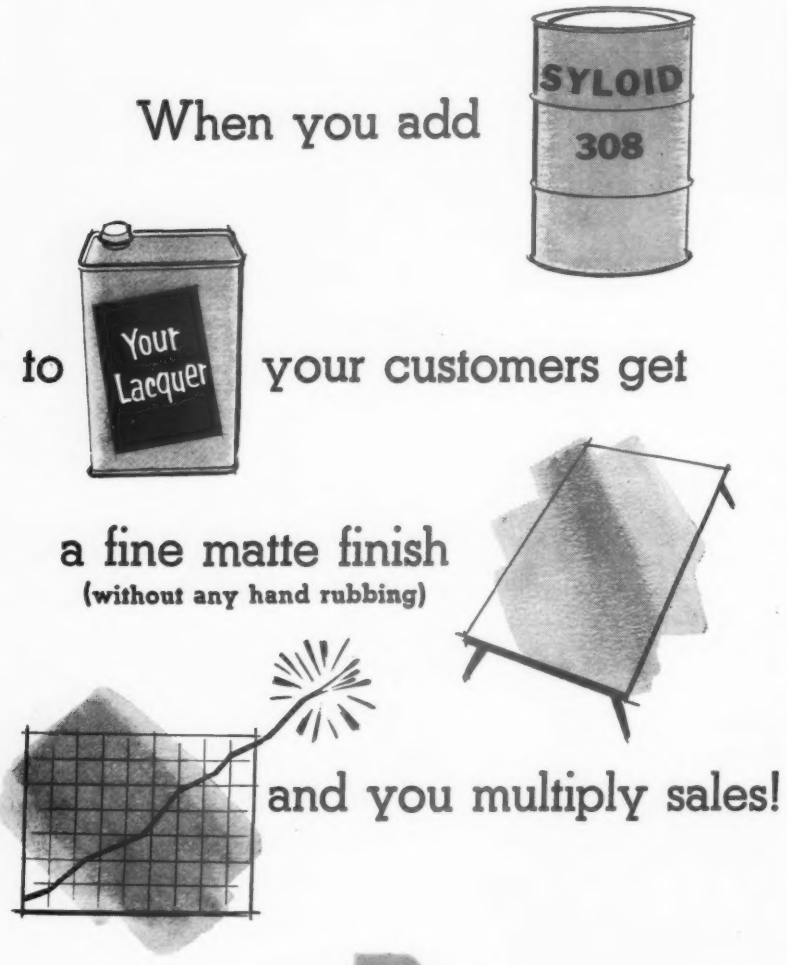
JOHN B. MOORE CORP.

John B. Moore has been appointed sales representative for all southern states, with headquarters in Miami, it has been announced by Irving Sarlin, president.

Mr. Moore is the author of a number of technical articles on solvents, and has recently been addressing groups of engineers and technicians on solvent safety.

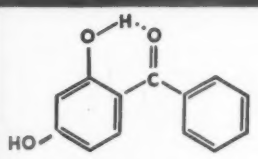
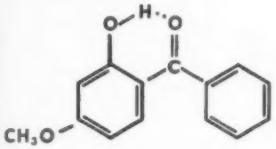
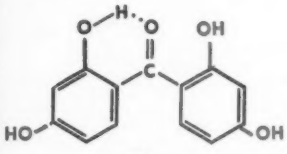
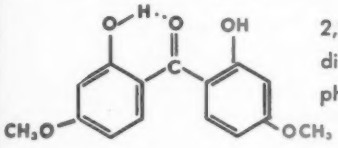
BROWN-ALLEN CHEMICALS

Samuel Kardon has joined the research and development staff, it has been announced. Mr. Kardon had formerly been with the Alleghany ballistics laboratory of Hercules Powder Co.



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nullifies ultraviolet light

Antara offers Uvinul Ultraviolet Light Stabilizers with a wide range of solubilities and absorption characteristics. Choice of the correct Uvinul depends upon the intended use.

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UVINUL M-40		2-Hydroxy-4-methoxy-benzophenone
UVINUL D-50		2,2′, 4,4′-Tetrahydroxy Benzophenone
UVINUL D-49		2,2′-Dihydroxy-4,4′-dimethoxy-benzophenone
UVINUL 490		2,2′-Dihydroxy-4,4′-dimethoxy-benzophenone, and a mixture of other tetra-substituted benzophenones.

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EMERY INDUSTRIES

Frank E. Eden has been promoted to the staff of the development and service department, it has been announced by W. T. Meinert, director of development and service.



F. E. Eden

Mr. Eden will be concerned with the market development of new chemical products, as well as with technical service. He has been a member of the firm's control laboratory staff since 1953.

He holds degrees in Chemistry and Law from the University of Cincinnati, and a master's degree in Business Administration from Xavier University. He is a member of the Ohio Bar Association.

CARPENTER-MORTON

William Fierman has been elected president of the firm, it has been announced. He will retain his present position as treasurer.

Mr. Fierman has been with the firm in various capacities for 45 years. He had been general manager of the firm since 1953, and is a member of the board of directors.

William Miller has been elected general manager, replacing Mr. Fierman. He will retain his present position as sales manager.

Mr. Miller is a graduate of Dartmouth College. He has been advertising and sales manager since 1955.

In other company elections, **William R. Holmes** has been named secretary and **Robert W. Andrews** has been elected to the board of directors. Mr. Andrews continues as the firm's technical director.

GOODYEAR

M. E. Wendt has been appointed manager of chemical materials and products development, according to an announcement by Dr. R. P. Dinsmore, vice president in charge of research and development.

Mr. Wendt has been with the company since 1938. He spent two years in research on coatings and adhesives, and then was transferred to the chemical engineering department where he played a prominent role in the organization of the preliminary pilot plant for production of synthetic elastomers. In 1952 he became manager of the chemical products development department.

Mr. Wendt is a chemical engineering graduate of Ohio State University, where he was twice selected to all-America football teams.



A. K. Hoge



M. E. Wendt

A. K. Hoge has been appointed special representative for the chemical division's Boston office, it has also been announced.

Mr. Hoge has had more than 16 years of experience in engineering research and development. He is a graduate of the College of Wooster with a degree in Chemistry, and has received a degree in chemical engineering from M.I.T., where he later did graduate work.

He has had several years of research work on plastic materials, and has been development manager for a plastics fabricating firm.

PABCO PAINT

John A. Elliott has been promoted to sales manager, southern district sales area, it has been announced.

Mr. Elliott has had more than 20 years of experience in the paint industry, including trade and industrial field selling, retail marketing and sales management. His headquarters will be at South Gate, Calif.

GENERAL MILLS

Thomas H. Boyd has been appointed New York district sales representative for the chemical division, it has been announced.

Mr. Boyd had previously been associated with Pittsburgh Coke and Chemical Co., where he served for nine years as a sales representative. He is a graduate of Bowdoin College.



Time Flies in ATLAS Weather-Ometers®



In developing new paint products—the new Atlas Weather-Ometer Model DMC will give accurate dependable forecasts of the weathering durability and color fastness of the product. Test programs can be exactly duplicated at any time to give accurate comparative data of various formulas.

For quality control in production — the Weather-Ometer is useful in maintaining the quality standard of the product, by checking each batch run for any deviation from the established weathering and light fastness standards.

Accuracy in test results is greatly increased in the DMC Weather-Ometer by a positive control of specimen temperatures. Automatic humidity control up to dew point is available as optional equipment.

Both horizontal and vertical testing is available. Shallow containers are used for semi-liquid material and vertical panels for solids.

All automatic controls including complete voltage controls are located on the front panel above the test chamber door. Source of light is two Atlas enclosed violet carbon arcs.

Write for complete Weather-Ometer® catalog.

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Aliphatic Petroleum Naphthas
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Waxes



What you want . . . *when* you want it . . . *where* you need it . . . all with just one *phone call!* That's the new "department store" way to order solvents and chemicals. It's the *modern* distribution system that saves you time, work and money.

One Order! Get top-quality products made by America's leading producers . . . delivered in drums, tank trucks, transports or tank cars.

One Delivery! Your order delivered within 24 hours in most cases through 17 service locations.

One Invoice! In many instances, orders for several products can be combined to give you even lower costs.

One Payment! Lower receiving costs and less paper work mean extra savings. You can maintain lower inventories and get insurance savings, too!

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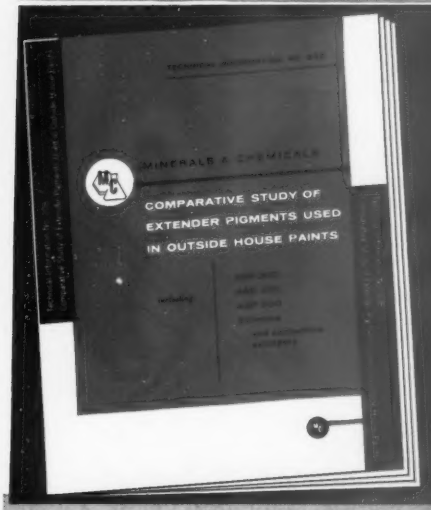
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outside paints
. . . a comparative
study

Literature Report: Under its policy of developing *reliable* recommendations and *extensive* and *informative* technical data, M & C offers a valuable bulletin just off press.

"Comparative Study of Extender Pigments Used in Outside House Paints" is filled with facts for paint technologists:

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2. Complete test fence readings at 1, 2, 3 and 4 years.
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KAOLIN (*Edgar • ASPs*)
LIMESTONE (*Chemstone*)
SPEEDI-DRI FLOOR ABSORBENTS

SERVICE AND STOCKS IN 30 CITIES

PICCO

Jack L. Wilson, R. W. Ostermayer, Jr., Dr. P. O. Powers and **L. J. Reizenstein** have been elected vice presidents, according to an announcement by the firm.



R. W. Ostermayer



J. L. Wilson



L. J. Reizenstein



P. O. Powers

The newly-elected officers will constitute the executive staff which will integrate new facilities of the company with existing production plants, and coordinate new product research with application and development of new product uses.

John W. Berg has been named Pittsburgh district sales manager, it has also been announced. He had formerly been Mid-Atlantic sales representative of the Alco Oil and Chemical Corp.

Mr. Berg attended Temple University and graduated from the University of Pennsylvania.

HOLLAND COLOR

T. A. McCormack has been promoted to the newly-created position of technical service manager, it has been announced.

Mr. McCormack joined the firm in 1954, after three years as manager of the pigment color division of United Wallpaper, Inc. He had previously spent 20 years as a member of the technical staff of the General Dyestuff Corp. sales division of General Aniline & Film Corp.

CUNO ENGINEERING

Earl G. Fugett has been named branch manager of the sales engineering office at Ardmore, Pa., it has been announced by C. H. Winslow, vice president.

Mr. Fugett will direct field sales and service activities in Philadelphia and a surrounding four-state area.

SHELL CHEMICAL

C. J. O'Sullivan has been assigned to the New York district office of the chemical sales division, according to an announcement by D. P. Jones, district manager.



C. J. O'Sullivan

Mr. Sullivan will be technical representative concerned primarily with sales of Epon resins. He had formerly been at the technical service laboratory in Union, N. J.

He is a graduate of St. John's University of Brooklyn, N. Y.

AMOCO CHEMICALS

Robert Kirk has joined the firm in Chicago as manager for the international sales of petroleum additives, solvents, hydrocarbon resins, plasticizers and chemical intermediates.

Mr. Kirk has had more than 10 years of experience in export sales, including six years as manager of the foreign division of Pittsburgh Coke and Chemicals Co., and president of Pittsburgh Chemicals Mexicana S.A.

He majored in Chemical Engineering at the University of Lausanne, Switzerland, and received a baccalaureate from Lemania College in Lausanne.

UNION CARBIDE CHEMICALS

D. P. Johnson, D. L. Peters and **R. C. Wise** have joined the development department, it has been announced.

Mr. Johnson attended North Carolina State College and received a B.S. in Agricultural Chemistry in 1948. He had been an insecticide chemist with the North Carolina Dept. of Agriculture.

Mr. Peters is a Chemical Engineering graduate of Purdue University. He did post graduate work at M.I.T. before his present association.

Mr. Wise attended Penn State and received a B.S. in Chemical Engineering.

REICHHOLD CHEMICALS

Charles B. Breedlove, Ernest M. Skytta, F. Albert Smiles and **Ralph T. Urich** have been elected vice presidents of the company, it has been announced.

Mr. Breedlove, manager of the Detroit plant since 1955, has been with the firm since 1942, when he joined the Detroit laboratory. He has also been a sales representative, district sales manager and regional sales manager. He is a member of the executive committee of the Detroit Paint Assoc.

Mr. Skytta, general manager of the Pacific Northwest division, joined the research department in Detroit in 1942. He had previously been a high school Chemistry teacher. He has been head of the physical and chemical testing division in Detroit, and has been with the phenol production department in Tuscaloosa, Ala., and the development department in Detroit. He has also been sales representative and district sales manager in Seattle.

Mr. Smiles, general manager of the Elizabeth, N. J., plant, joined the technical service laboratory there in 1942. He later headed the firm's development and service laboratories of the eastern technical division, and also headed that division.

Mr. Urich, general manager of the New England division, has been with the firm since 1939, when he became associated with sales and research connected with inorganic colors. He has been sales manager of the color division, and served with the War Production Board during World War II.

WITCO

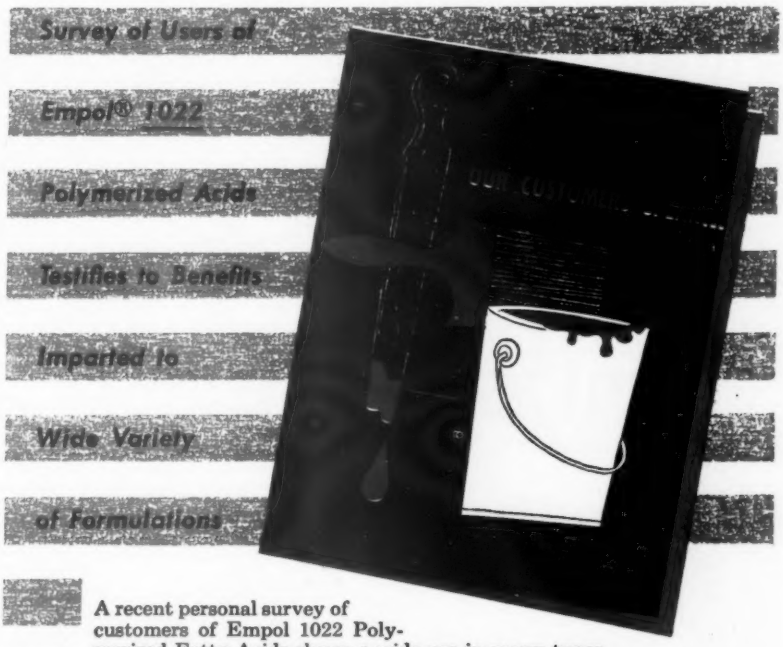
James Cunningham has been named sales manager of the newly-formed Witco Chemical Co., Canada, Ltd., it has been announced. His headquarters will be in Toronto.



J. Cunningham

Prior to his new appointment, Mr. Cunningham had been sales representative in the New York area for the parent firm. He has been with the company since 1944, serving as chemist, technical service representative and manager of the firm's stearate plant in Brooklyn.

He studied chemical engineering at Brooklyn Polytechnic Institute and New York University.



A recent personal survey of customers of Empol 1022 Polymerized Fatty Acids shows a wide use in many types of industrial and trade surface coatings. Among these are short, medium and long oil length varnishes and drying, semi-dry, and baking alkyds.

More important, however, were the benefits realized. Such properties as *increased flexibility* and shorter cooking times ranked high. Following close are better through-dry, increased alkali resistance and added body. Others are increased acid resistance, better weathering and increased hardness.

For more details on this survey, or a 20-page descriptive booklet on Empol 1022, or a one-pint evaluation sample, mail coupon below.

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In Canada: Emery Industries (Canada) Ltd.,
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Emery Industries, Inc.
Dept. X-10, Carew Tower, Cincinnati 2, Ohio
Please send:
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Company.....
Address.....
City.....State.....

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SHELL AROMATIC SOLVENTS

with wide variety of evaporation ranges

SHELL TOLUENE ... for applications where very fast evaporation and high solvency are required.

SHELL XYLENE ... has an exceptionally narrow distillation range, is slower drying than toluene.

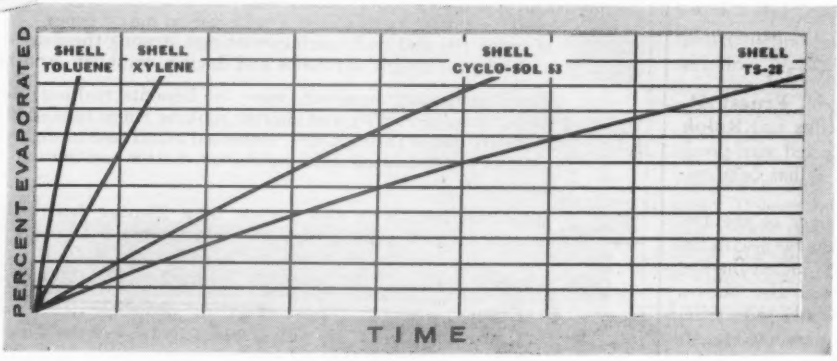
SHELL CYCLO-SOL 53 ... an excellent solvent with higher flash point and slower evaporation than xylene. Recommended for bake finishes and flow coating.

SHELL TS-28 SOLVENT ... a still slower drying aromatic concentrate of medium high solvency. Recommended for bake finishes and flow coating.



Typical properties are given in the booklet shown. Write for a copy.

These Shell solvents cover a very wide evaporation range. Their individual characteristics satisfy specific requirements in a great variety of formulations.



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SHELL

SUN CHEMICAL CORP.

Julius E. Spector has been elected vice president of the corporation, it has been announced by Norman E. Alexander, president.



J. E. Spector

Mr. Spector has also been appointed general manager of the Paints and Finishes Group, a corporate designation for A. C. Horn Companies, subsidiaries and divisions of the parent firm.

Mr. Spector has joined the firm after 11 years with the eastern division of National Chemical & Mfg. Co., Inc., where he had been technical director and plant manager. He is a graduate of City College of New York, and has attended Stanford University. He has also done graduate work at New York University and Brooklyn Polytechnic Institute.

William J. Leyden has joined the Warwick Chemical Division, it has also been announced. He has been appointed technical service representative for the Midwest and Southwest. He is a graduate of Miami University.

GENERAL ANILINE & FILM

Harold G. Shelton has been appointed director of marketing for the dyestuff and chemical division, it has been announced.

Mr. Shelton had been sales manager of Antara Chemicals since he first joined the parent organization in 1945. In his new position he takes over responsibility for all marketing and sales activities of the division, including that of the General Dyestuff Co.

He served for approximately 13 years with Union Carbide prior to becoming Antara Chemical sales manager. He received a P.S. in Engineering from Virginia Polytechnic Institute.

PITTSBURGH COKE & CHEMICAL

Norman T. Shideler has been elected president of Insul-Mastic, Inc., a newly-acquired subsidiary producing for the protective coatings division, it has been announced.

Mr. Shideler will also act as technical advisor to the vice president-chemical division on industrial protective coatings and tar products of the firm. He will also have responsibility for all coatings research and development.

A graduate of Indiana University, Mr. Shideler has been with the firm since 1948. Prior to that he had been a research chemist for such firms as Reilly Tar & Chemical Corp. and Wailes-Dove-Hermiston.

Arthur E. Gray has been named to succeed Mr. Shideler as general manager of the protective coatings division, it has also been announced.

Mr. Gray has been with the company since 1952, and has been assistant manager and sales manager of the protective coatings division. His past associations include Pipe Protection Service, where he had been vice president and sales manager, and Certainteed Products and Electrical Research Products.

Samuel C. Colbeck has been appointed a buyer in the chemical procurement department. He has been with the firm since 1929, when he became a cement sampler.

A graduate of Carnegie Institute of Technology, Mr. Colbeck has served as research chemist and chief chemist in the cement laboratories and in the activated carbon division. Prior to his promotion he had been a technical sales representative.

ENJAY

H. William Peterson has been named assistant manager of the alcohols and chemicals division, it has been announced.



H. W. Peterson

Mr. Peterson has been with the firm for six years. He had formerly been district supervisor in the middle Atlantic states area. Previously he had spent five years with the Bayway Refinery of Esso Standard Oil Co.

He is a graduate of Colgate University. He has earned several process patents involving the utilization of petrochemicals in the manufacture of waxes and heating oils.

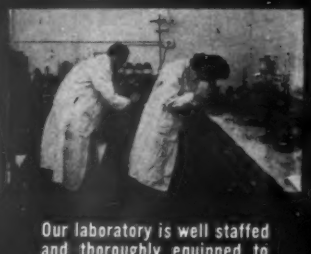
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Technical Director of coating formulations and research. Has had 25 years of experience in the paint field.



Our laboratory is well staffed and thoroughly equipped to formulate all types of coatings for you.



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D. H. LITTER CO.

Bernard S. Karten has been appointed senior chemist in the Daniel-Litter Laboratories division, it has been announced by Sidney B. Levinson, technical director.



B. S. Karten

Mr. Karten will be engaged in the consulting service of the laboratories, specializing in the evaluation of fine sized silicas and their application and formulation in flat and semi-gloss finishes.

Mr. Karten is a graduate of City College of New York, and is completing graduate studies in the field of Isocyanates and Isothiocyanates. He had formerly been associated with Adelphi Paint and Color Works, Inc.

DIAMOND ALKALI

C. R. Brown, assistant works manager-employee and public relations at the firm's Painesville plant, has been promoted to director of labor relations, it has been announced.

Mr. Brown has been with the company since 1950, when he became industrial relations manager at the Painesville plant. He is a graduate of the University of Pennsylvania.

Albert J. Ingley, manager of insurance, is now manager of employee benefits and salary administration.

A graduate of Yale University, Mr. Ingley has been with the firm since 1946, and had been a staff assistant in the treasurer's department prior to his promotion to manager of insurance.

Glenn H. Varney, assistant personnel manager, has become manager-employee recruiting and management development. He has been with the company since 1956.

Mr. Varney had previously been assistant to the director of industrial relations at the F. C. Russell Co. in Cleveland. He holds B.S. and M.B.A. degrees from Ohio State University in personnel administration.

Dr. Clifford A. Neros has become group leader in the product development section of the central research department, it has also been announced.

Dr. Neros joined the company as a chemist in 1945, and has since supervised the technical service laboratory and has participated in the development of solvents, adhesives, plastics and flame-proofing compounds.

He obtained bachelor's and master's degrees at the University of North Dakota, and a doctorate from the State University of Iowa.

James L. Foster has become group leader in silicate research for the silicate, detergent, calcium division.

Mr. Foster has been with the company for 12 years. He has been a research chemist and has been engaged in both organic and inorganic research and technical service activities. He has been acting group leader in silicate research since 1954.

He is a graduate of Delta State College, and has taken graduate work at Ohio State University.

NEW JERSEY ZINC

Clyde A. Berger has been promoted to the position of pigment development manager, it has been announced. His headquarters will be in New York.



C. A. Berger

Mr. Berger has had more than 20 years of experience as a pigment sales representative and in pigment research. He is an alumnus of M.I.T.

In his new position he will be responsible for improvement of the quality of zinc and titanium pigments, and he will direct the sales engineering staff in pigment sales service.

A. G. McFadden, pigment sales representative, has been transferred to Atlanta, Ga., and **C. H. Petterson** has been moved to Detroit.

Samuel Riker, Jr., has been elected secretary of the firm replacing Walter R. Anyan, who has died. Mr. Riker will also continue as treasurer.

NOW!
SELF-SANITIZING PAINTS with
NUOZENE

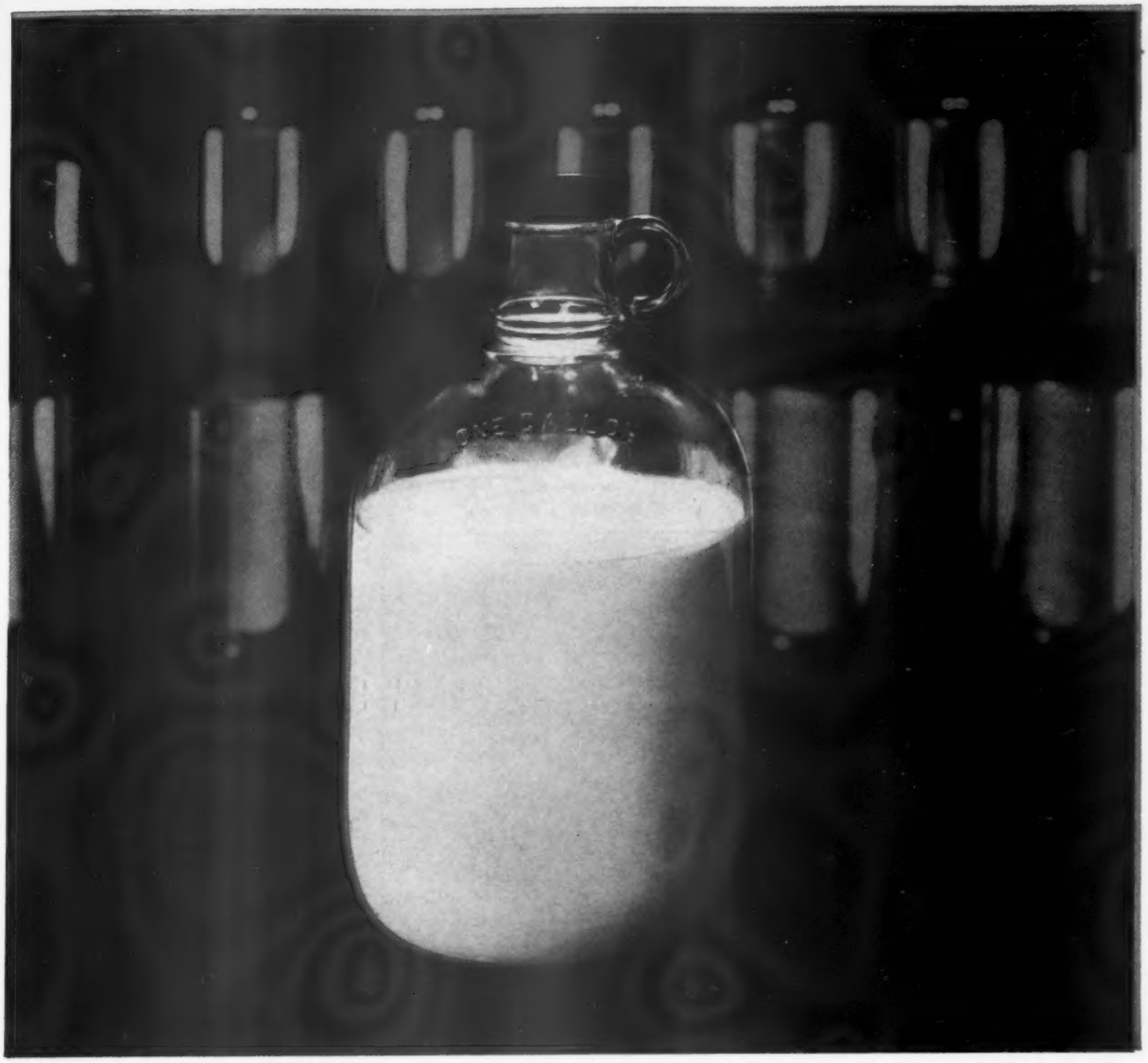
Whole new markets will open up to self-sanitizing paints, easily produced by the addition of NUOZENE—newest item in the Nuodex line.

The basic story is brief: paint films containing NUOZENE *destroy bacteria and fungi,* and the effect lasts through repeated washings. Applications? Everywhere—hospitals, food processing plants, nurseries—*every home!*

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TO HELP MAKE GOOD PAINTS BETTER
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"Elvacet" is an all-purpose vehicle with excellent storage and mechanical stability, outstanding uniformity and compounding characteristics.

6 years old—and still stable!

The jug you see above contains an "Elvacet" polyvinyl emulsion that's 6 years old—yet it's still as free-flowing and usable as the day it was made. *Proof* that you can rely on the stability of "Elvacet" in a properly formulated PVA paint!

Du Pont has been making—and continually improving—polyvinyl acetate emulsions for more than 15 years. Today, paint manufacturers have a choice of "Elvacet" emulsions to use in making a variety of fast-selling PVA paints. All "Elvacet" PVAc emulsions are top-quality—and all are backed by Du Pont research and technical service.

For expert advice and help in formulating quality PVA paints, call any of the district sales offices listed below.

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COLUMBIAN CARBON

Lawrence M. Baxt has joined the colloidal dispersions department as chief chemist, it has been announced. He will be located at the Tacony plant in Philadelphia, where he will be in charge of newly-completed laboratories for technical service, quality control and development.



L. M. Baxt

A native of Canada, Dr. Baxt is a physical chemistry graduate of McGill University in Montreal. He received a doctorate in 1939 from the Imperial College of Science and Technology in London.

Dr. Baxt has had experience in inks, pigments and synthetic resins with the Underwood Corp. and with Bakelite Co., division of Union Carbide Corp.

ARCHER-DANIELS-MIDLAND

Burton W. Schroeder and **John H. Daniels** have been elected vice presidents of the company, it has been announced.

Mr. Schroeder is assistant manager of the firm's chemical products division, and had been assistant to the president. He joined the company after graduation from the University of Michigan in 1939 with a degree in Chemical Engineering.

Mr. Daniels is in charge of production for the alfalfa division. He is a graduate of Yale University, and has been a flax buyer and assistant sales manager and sales manager for linseed oil. He was elected an assistant vice president in 1955.

Eight executives have been elected to the company's advisory committee, which helps evaluate new ideas and projects under consideration by management, and serves as a forum for company employees.

Elected to the committee are: **Dr. E. T. Clocker,** research supervisor; **J. B. Deininger,** assistant general traffic manager; **E. S. Eichhorn,** manager, systems and procedures; **W. G. McFadzean,** manager, distribution and warehousing, and **L. H. Workman,** grain buyer, all elected for three-year terms.

Howard Nissi, manager, salary administration and the Minneapolis office; **James Sellner,** manager, soy specialties department, and **Paul Werler,** manager, industrial cereals and fatty acids departments, have been elected for one-year terms.

K. E. Holt, control director, and **G. C. Mairs,** assistant manager of the flour division, have been elected co-chairmen of the committee for the coming year. Mr. McFadzean has been named secretary.

John O. Florence, technical sales representative in the Houston, Texas, area, has been transferred to the isolated soy protein sales department, with headquarters at Evendale, Ohio.

G. B. Davidson, technical sales representative in Chicago, replaces Mr. Florence in Houston, and **E. H. T. Drake,** formerly a salesman for Price Varnish Co., has been assigned to the Chicago office to replace Mr. Davidson.

Richard M. Benton has been assigned as a technical sales representative at the Philadelphia office, and **Gordon Bader** has been named to a similar post at the Cincinnati office.

SHERWIN-WILLIAMS

Harold S. Cropper has succeeded the late Fred G. Elchlepp, Jr., as Memphis area manager, it has been announced.

Mr. Cropper has been associated with the firm in a variety of sales and supervisory positions since 1935. He had been branch operating supervisor in the Atlanta regional headquarters prior to his new appointment.

He is a graduate of the University of Cincinnati.

SCIENTIFIC OIL

George B. Horsfull of Grosse Pointe Park, Mich., has been appointed representative in the Detroit and eastern Michigan territory, it has been announced.

Mr. Horsfull will handle sales of vegetable oils and chemical specialties for the paint and adhesive industries.

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SUCO

Modern research methods continue to develop . . .

new Ultramarine Blues

Since our entry into the Ultramarine Blue field forty-seven years ago, our goal has been to provide our customers with unexcelled Blues of superior quality. In keeping with this policy, we announce the addition of a new series of Ultramarine Blue standards.

The outstanding qualities of these new Blues are:

Higher strength
Better money value
Richer deep tones.

All SUCO Blues, including the new standards, are offered with the advantages of:

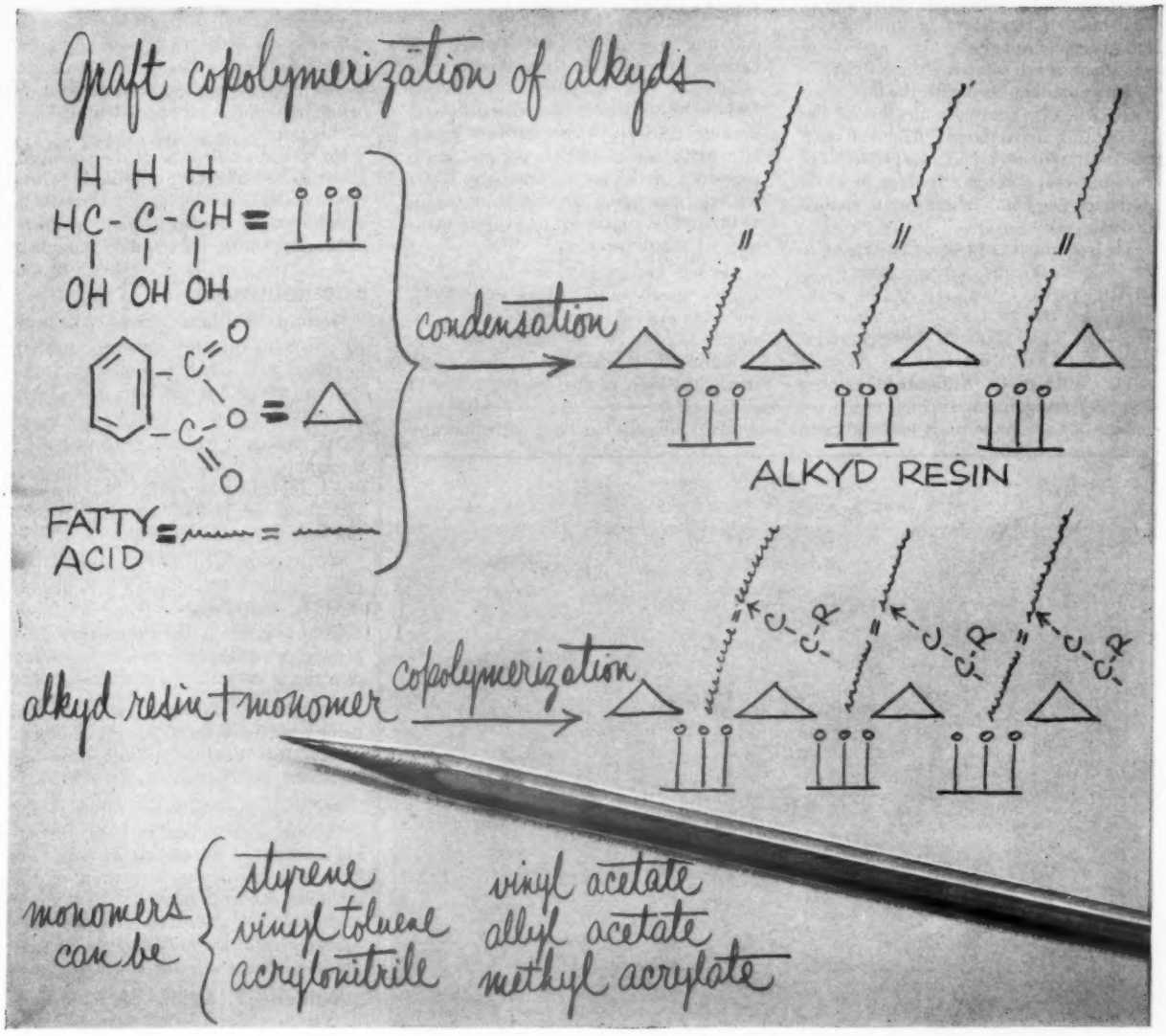
Excellent standardization
No free sulphur.

As the only domestic producer of Ultramarine Blue we offer the best in quality, service and dependability. May we suggest that you contact one of our local field offices or agents for further information or write direct to our home office for samples of the new standards that will best meet your needs.

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BRANCH OFFICES AND AGENTS: Standard Ultramarine & Color Co., Newark, Philadelphia, Chicago, New Orleans — Standard Ultramarine & Color Co., Ltd., Toronto and Montreal, Canada—J. C. Drouillard Co., Cleveland—Thompson-Hayward Chemical Co., Kansas City, and Branches—Paul W. Wood Co., Los Angeles and San Francisco — L. E. Crossley, Boston. Also agents in other principal cities.



Better copolymers come easy when you use Glycerine alkyds

Glycerine alkyds react well with a great variety of monomers. They yield interesting copolymer vehicles that give coating manufacturers a whole new spectrum of properties to work with.

Glycerine alkyds, because they have less tendency to gel during cooking, permit far more flexibility in the condensation process. And the resulting copolymers are more soluble, have better clarity and do not haze as readily as those based on other polyols.

Glycerine offers additional benefits in making alkyds—either copolymer or conventional types. Glycerine is a liquid, which simplifies handling. There are no bags to lift, no fines. And the chemistry of Glycerine alkyds has been thoroughly explored. Methods of use in the plant are perfected and literature abundant.

As year after year proves, nothing takes the place of Glycerine.

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Nothing takes the place of Glycerine

AMERICAN CYANAMID

Kenneth C. Towe has been elected chairman of the board of directors, it has been announced. He had been president of the company since 1952.

Mr. Towe has been with the firm since 1926, when he became a member of the accounting department. He had been assistant treasurer and comptroller before being appointed treasurer in 1939, and vice president in charge of finance in 1945.

He is a director of Guaranty Trust Co. of New York, and Putnam Trust Co. of Greenwich, Conn. He is also a director of the N.A.M., a national director of Boys' Clubs of America and a trustee of Duke University.

Dr. Wilbur G. Malcolm has been elected president and chief executive officer of the company, it has also been announced. He had formerly been vice president for marketing.

Dr. Malcolm has played an outstanding role in the development of Lederle Laboratories, Inc., now a subsidiary of the company. He joined Lederle in 1934 as a bacteriologist, and became executive director four years later at the age of 36. He became a vice president of the parent company when Lederle was given divisional status in 1946, and he continued as general manager of the division.

He has been a member of the company's board of directors since 1944, and was elected to the executive committee in May of this year.

Kenneth H. Klipstein, vice president, has been elected to the board of directors.

Mr. Klipstein has been with the company since 1933. He served as chairman of the new products program committee of the former Calco Chemicals division, assistant general manager of that division and as general manager of the parent firm's research division, before becoming a vice president in May of this year.

He served as director of the chemical division, and assistant administrator of the chemical, rubber and forest products bureau of the National Production Authority during 1951 and 1952.

DOW CHEMICAL

Donald Williams, vice president and director of sales, has been named to the newly-created position of director of corporate relations, it has been announced.

Mr. Williams will be concerned with the company's relationships with other firms, including those in the chemical and allied industries, customers, potential customers and suppliers.

He has been with the company since 1924, when he joined as an agricultural chemical salesman. He had been assistant general sales manager and general sales manager before becoming director of sales.

Donald K. Ballman, general sales manager, has replaced Mr. Williams as director of sales, it has also been announced.

Mr. Ballman began his career in the Dowicide sales section in 1935, becoming manager of the section in 1937. He later supervised the formation of the technical service and development group and became assistant general sales manager in 1945. Four years later he became general sales manager.

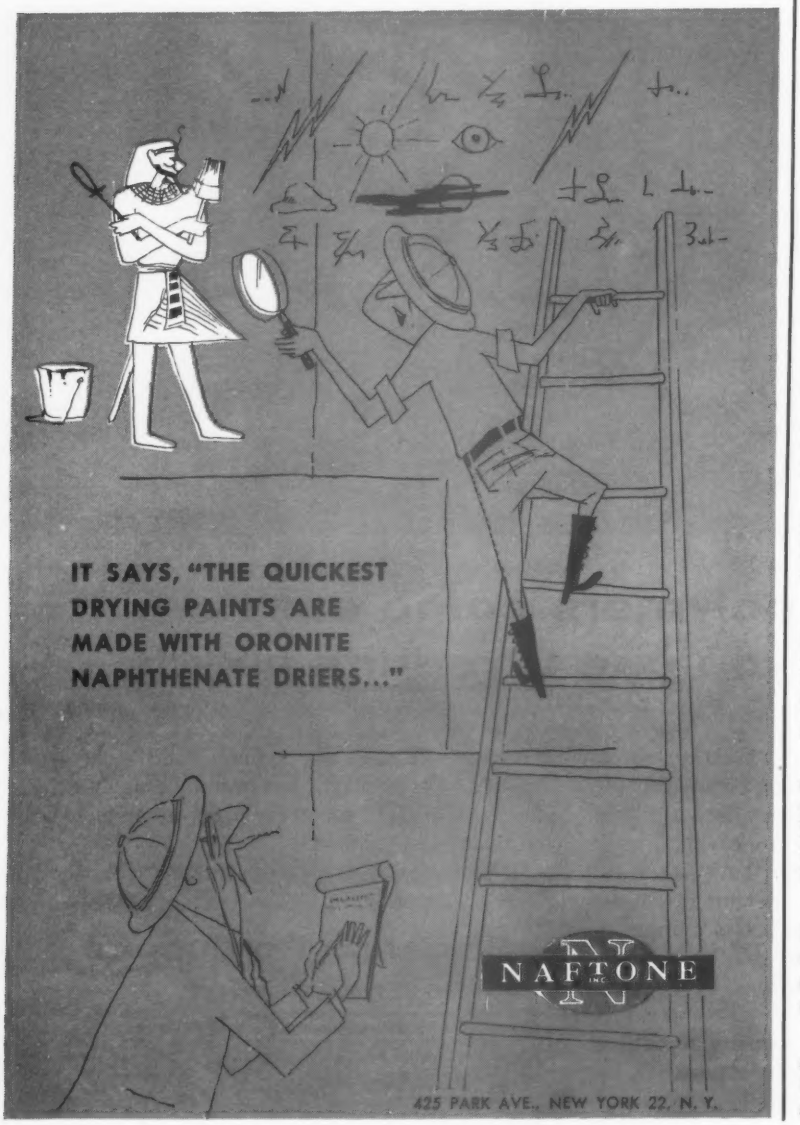
William R. Dixon has been promoted to general sales manager. He had been assistant general sales manager under Mr. Ballman.

Mr. Dixon has been with the company since 1936, and has held various sales posts. He was the firm's first branch office salesman in the plastics field, and he managed the plastics department from 1943 to 1951.

Eugene L. Martinez has been promoted to manager of the Boston sales office, it has also been announced, and **E. H. Killheffer, Jr.,** has been named to succeed him as manager of the Buffalo sales office.

Mr. Martinez had been manager at Buffalo since 1955. He had joined the company ten years earlier, spending most of the time as a chemical salesman on the New York staff.

Mr. Killheffer had been in magnesium sales since he joined the company in 1943, and had been head of magnesium sales in the New York office since 1948.



NEWS

Class Schedule Announced

Podbielniak Institute, organized a year ago as an experimental project for serving industry by offering intensive two-week courses in new methods of analysis, has announced a schedule of classes for the 1957-58 academic year.

The regular teaching staff is composed of lecturers who are authorities in their respective fields. Guest lecturers supplement regular instructors.

A special one-week courses in "Reviewing Low and High Temperature Distillation" has been scheduled for those wishing to combine one week of that subject with one week of "Reviewing Vapor Phase Chromatographic Techniques," which is the regularly scheduled two-week course.

The schedule follows:

Reviewing low and high temperature distillation: March 3-8.

Reviewing Vapor Phase Chromatographic techniques: Dec. 2-14, March 10-22, May 5-17.

•

J. R. Esposito Passes

Joseph R. Esposito, former president of Interchemical Corp.'s finishes division, died recently after an illness of several weeks. He was 72 years old.

He had been awarded a plaque in July commemorating his 50 years with the firm. Mr. Esposito retired from consultant duties on June 30.

He began his career with Interchemical as a salesman for Ault & Wiborg Varnish Works, Inc., a predecessor company, in 1907. He became president of Ault & Wiborg in 1931.

Mr. Esposito was elected a director of Interchemical in 1935, later becoming a vice president. He had been a consultant to the firm for the past seven years.

In 1933 Mr. Esposito was instrumental in founding the Industrial Finishes Division of the National Paint, Varnish & Lacquer Assoc.

Announce Container Coatings

Bradley Container Corp. has announced the development of two external coatings for polyethylene containers.

A varnish coating, "High Gloss," is said to impart a high sheen when applied to polyethylene. It is also said to deepen and sharpen label colors, eliminate static and provide a tough, durable finish.

"Barrier Gloss," second of the coatings, is said to give natural polyethylene a glass-like clarity. The firm says its coating also helps to reduce permeation of essential oils and slows the transmission of oxygen through the container walls.

Canadian Subsidiary Formed

Pennsalt Chemicals Corp. has announced the formation of a wholly-owned subsidiary in Canada, known as Pennsalt Chemicals of Canada, Ltd.

William B. Billingsley, who has directed Pennsalt specialty sales in Canada since 1954, has been named vice president of the new subsidiary and resident manager of its operations. He was associated with Canada Industries, Ltd., prior to joining Pennsalt.

The firm plans early construction of manufacturing and warehousing facilities in eastern Canada, the announcement said.

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In Color and Sheen Uniformity!



Across the nation an ever-increasing number of paint manufacturers are discovering the unique properties of paints based on FAFL.

Wherever flat paints must stand up to a demanding challenge—the utmost in color uniformity—sheen uniformity—color retention—washability—easy application—durability and long pleasing appearance—for interior or exterior surfaces—paints based on FAFL are providing unsurpassed performance.

Increase your alkyd flat paint sales with FAFL



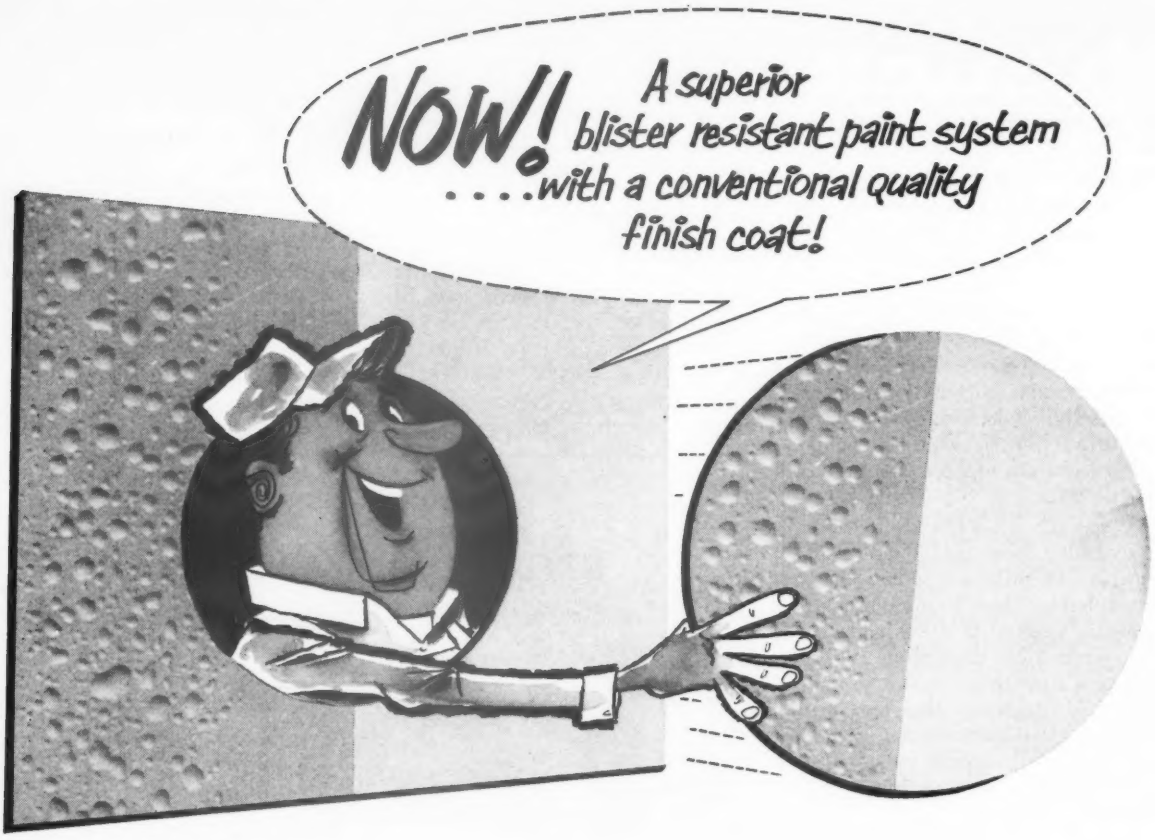
FAFL-OD for Odorless Paints is a great sales-getter. Used also for government specification paints.
Write for samples and complete information.

SPECIFICATIONS

VISCOSITY	V-Y
NON-VOLATILE	30% ±1%
COLOR	6 Maximum
ACID NO.	10 Maximum (on solids)
WEIGHT per gal.	7.3 lbs.
TYPE	Pure drying oil alkyd

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TEST PANEL on right shows that no blistering occurred in the paint system using a primer formulated with Eagle-Picher Super Sublimed White Lead—top coated with Federal Specification TT-P-103.

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NEWS

Du Pont Plans Cuban Plant

Du Pont has announced plans to construct a paint plant in Cuba to manufacture Du Pont finishes for the Cuban market. The plant will be operated by Du Pont Inter-America Chemical Co., Inc.

The plant's products will include lacquers, enamels, paints, varnishes and thinners for the industrial, automotive refinish, household and maintenance fields.

Construction is scheduled to begin early in November. The plant will be located in the new industrial section of San Jose de las Lajas, approximately 25 miles southeast of Havana. Manufacturing operations are expected to begin September 1, 1958.

The plant will provide employment for approximately 100 people.

•

ADM Opens Detroit Office

Archer-Daniels-Midland Co. has opened a new branch sales office in Detroit, it has been announced by James W. Moore, ADM vice president and director of marketing.

Eugene L. Bulgozdy, former technical sales representative at Cleveland, manages the new office. Gerald C. Berry, also of the Cleveland staff, has been transferred to Detroit as a technical sales representative.

The new office is under the supervision of Hall S. Dillon, Cleveland regional sales manager. Ronald W. Bonatz continues to handle sales of ADM chemical products.

The office is located at 18333 James Couzens Highway.

•

To Handle Southern Sales

The appointment of A. J. Passono Co. of 107-22nd St., Bellair Beach, Fla., as manufacturer's representative has been announced by Diamonite Products Mfg. Co.

The newly appointed firm will handle Diamonite high alumina ceramic grinding rods in Alabama, Mississippi, Georgia, Florida and Louisiana.

Sponsor Princeton Study

The American Lithium Institute will sponsor a research program on the role of lithium and its compounds in polymerization reactions at Princeton University, it has been announced.

The project will be under the direction of Professor Arthur V. Tobolsky of the Department of Chemistry.

Lithium and its compounds are to be used experimentally as initiators and modifiers in vinyl polymerization and copolymerization. An intensive study is to be made of the rates, molecular weights and copolymer compositions of the materials.

Professor Tobolsky said that the project is welcome at Princeton as an aid to graduate education in chemistry through the promotion of scholarship and research.

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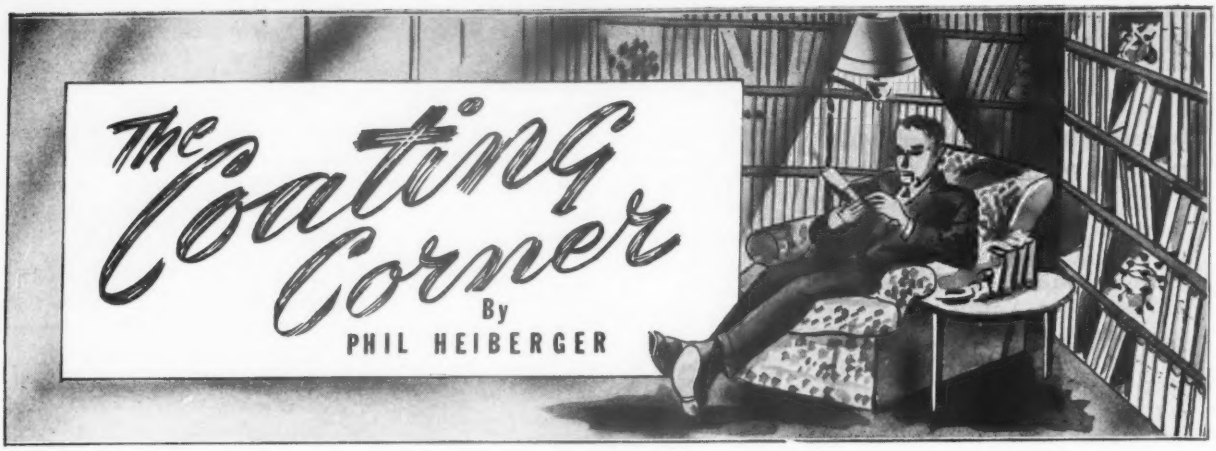
Karl R. McBride Dies

Karl R. McBride, 79, chairman of the board of the Imperial Paper and Color Corp., died at his home in Glens Falls, N. Y., recently after a long illness.

Mr. McBride had been with the firm since 1907, when he was employed as a chemist to produce pigment colors. He served in various managerial capacities in the color division until 1931, when he became president of the corporation.

He became chairman of the board in 1953.





The author continues his random reflections on various aspects of the paint industry. The opinions expressed in this column are his alone and do not necessarily reflect those of this publication.

WE seem to be hitting the jackpot this month with three references to recent issues of *Scientific American*.

Frozen Free Radicals

An article in the March 1957 issue of *Scientific American* brings to mind an extra-curricular discussion that took place several years ago. Somehow it was suggested that the most durable paint film is usually derived from an unstable, and therefore unsaleable, paint. That remark started a chain reaction of idea hopping.

Without attempting to recall every hop along the way, the thought that emerged was this: If the unstable paint can be stabilized by freezing, maintained in the frozen state, sold as a frozen product, and used immediately upon thawing, some mighty good paint products can be made. Naturally, terms like "irradiation", "free radicals", "reaction rates" were bandied about by the more imaginative participants in this gay discussion, while the more judicial thinkers muttered phrases like "impractical", "economically unfeasible", and the like.

The fact that the food industry has solved this problem was not completely overlooked, but, after all, can *you* imagine the problems involved in selling "frozen paint?"



Phil Heiberger

Come to think of it, weren't similar comments made against two package systems a few years back?

At any rate, my object at the moment is to bring your attention to the activity in an exciting new field of research—frozen free radicals. And rather than refer you to esoteric (and often unreadable sources), the review article by Charles M. Herzfeld and Arnold M. Bass, both active workers in the field, in the aforementioned March 1957 issue of SA, entitled "Frozen Free Radicals," is ideal for a quick review and brief reference to the field.

Free radicals, which normally have a fleeting existence during chemical reactions, can now be preserved by rapid cooling. The study of their properties is fascinating. By understanding free radicals, an understanding of the chemistry of the universe, of life processes, and even lesser areas, such as polymerization, is becoming possible. Freezing the free radicals permits a leisurely examination and the results so far are so startling that a new field of science is being opened.

Much of the work is being carried on and coordinated at the National Bureau of Standards in Washington, D. C. Under an unusual plan, the free radical program is getting an assist from industry. About half of the staff, which at full strength will number about 30 senior scientists (including another 20-30 laboratory technicians and secretarial help), is being loaned from industry. (*Chemical Week*, March 2, 1957).

At the moment, free radical research is strictly fundamental. At this time, there is no practical scheme for using stored free radicals directly in chemical reactions. But the real possibility that it can be done makes this program so important.

Isotope Economics

IN the July 1957 issue of *Scientific American* under the above head-

ing, a report on a speech made by Willard F. Libby deserves attention. In three to five years, U. S. industry and agriculture will be saving $5 billion annually through the use of isotopes produced in the atomic energy program.

According to an AEC survey, U. S. industry saved about $390 million through the application of isotopes in 1956. Density and thickness gauges were worth some $110 million to manufacturers of cigarettes, sheet metal, paper, rubber and fabric for tires, and other products. The petroleum industry saved $150 million by using tracers to help improve the yield of oil wells and another $30 million or so by other applications. Radioactive tracers make possible the detection of minute amounts of wear, and saved $15 million in studies of wear in piston rings and similar devices. The value of radiographic testing with isotopes is put at $42 million; of industrial tracing, $18 million; of other industrial research with isotopes, $15 million.

Assuming a large market for isotopes, many of them could be produced much more cheaply than they are today. Libby estimates, for example, that cobalt 60, now selling at $9 per curie, could be made for $.06; carbon 14, selling at $22,000 per curie, for $110; sulfur 35, selling at $2,000 per curie, for $.005; iodine 131, selling at $550 per curie, for $.0004.

On The "Phytotron"

LET's hope that the next time you sit down to a beautiful bowl of strawberries your berries will have come from plants that were exposed to the proper light and temperature conditions for at least a week and will have ripened while the early morning temperature was about 50 degrees. Otherwise, you'll undoubtedly be dismayed to find that, though red, sweet, and slightly acid, your strawberries have little strawberry aroma and no distinctive strawberry flavor!

That's the word of Frits W. Went, of the Earhart Plant Research Laboratory, California Institute of Technology, who writes in "Climate and Agriculture," in the *Scientific American* of July, 1957 about the science of agroclimatology, and recommends that more research teams comprising meteorologists, climatologists, agriculturists, and plant physiologists devote themselves to this important subject.

Although not much specific information has been gathered as yet, it has definitely been established that climate influences the biochemistry of plants. Witness the above data on strawberries, which also helps explain why the first strawberries of the season are usually the best. Later on, the early morning temperature is likely to be too high for optimum development of flavor and aroma.

Went cites other examples of the vital relation between climate and agriculture. Peach and pear trees, painstaking experiments at the Earhart laboratory have proven, require winter temperatures of below 40 degrees for several months, and unless they have passed through a sufficiently cold winter, they will not open leaf or flower buds in the spring.

Tomatoes require daily alternation of warm and cool temperatures. If day temperatures are correct but night temperatures are too low or too high, plants do not set fruit.

For nearly a decade, investigation of the effects of climatic factors on plants has been carried on in the Earhart Laboratory. Popularly called the "phytotron" from phyton (the Greek world for plant) and tron (suggesting the contribution of physics to its remarkable equipment), the laboratory is a building containing 54 separate green houses each provided with elaborate equipment for controlling climatic factors that effect growth and development of plants, such as day temperature, night temperature, light intensity, duration of daily illumination, light quality, relative humidity of the air, wind, rain, and gas content of the air.

"As we learn more about plant responses to climate," Mr. Went states, "we undoubtedly will find more ways to control their growth, and it is a comforting thought that technology is so advanced in our present world that almost any technical problem can be solved if it is urgent enough.

"We have considered the possibilities of adjusting climate to plants; to what extent can we adjust plants to a climate?" Went asks, then answers, "There is very little scientific evidence to support the idea that over the course of time a given variety of plant can become acclimated to conditions for which it is not originally suited. The soundest scheme is to attempt to breed new varieties which are fitted to the climate."

Why limit this kind of research to food crops only? we wondered. Why not sponsor research for industrial crops? For example, for increased conjugated unsaturation in drying oils, rather than just higher yields of oil? Higher quality rubber from Hevea brazielensis rather than increased latex yield, etc.?

Senator Hickenlooper made a statement to similar effect recently when he attended the official opening of Clinton Corn Processing's new research center in Iowa. Said Hickenlooper, "the time might come when certain types of corn could be grown primarily for their industrial starch rather than their food value. Strains of corn have shown great promise as raw materials for the industrial world, but very little work has been done along this line. Corn research may someday usher in a whole new industrial era."

Reaction Lacquers

OLD timers in the industry (i.e., five years or more) are wont to classify finishes into two general categories: the thermoplastics, those which dry solely by solvent evaporation, with or without the aid of heat; and the thermosetting, those which dry by chemical conversion, whether aided by heat, catalysts, or oxygen.

Now H. Kittel writing in the *Deutsche Farben Zeitung 10, 1648 (1956)* introduces a third broad category—reaction lacquers. He defines reaction lacquers as those coatings in which film formation takes place as a result of a chemical reaction between two or more film components, with or without catalysts.

Reaction lacquers known today include the polyisocyanates, the epoxide-amine adducts, unsaturated polyesters, and wash primer lacquers, but not cold-hardening phenolic or urea lacquers.

PATENTS

Complete copies of any patents or trade-mark registration reported below may be obtained by sending 50c for each copy desired (to foreign countries $1.00 per copy) to the publisher.

Preparation of Phthalocyanine Pigments

U. S. Patent 2,799,595. Stanley F. Kudzin, Leonia, N. J., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del., a corporation of Delaware.

The process of sub-division of a chlorine-containing phthalocyanine pigment containing 2 to 15 mol percent of a cosynthesized phthalocyanine 4-monosulfonic acid which comprises ball-milling the pigment suspended in 5 parts to 10 parts by weight or a chlorinated hydrocarbon for each part by weight of the pigment with grinding elements not greater than 0.25 inch in diameter, removing said chlorinated hydrocarbon by steam distillation after completion of the ball milling step, and then drying the pigment.

Nitrocellulose Coating Composition for Metals

U. S. Patent 2,798,014. Gregory N. Bruxelles, Newport, Del., assignor to Hercules Powder Co., Wilmington, Del., a corporation of Delaware.

A coating composition comprising the reaction product of a solution of 0.5 to 5 parts by weight of chromium trioxide, 1 to 20 parts by weight of phosphoric acid, and 10 to 200 parts by weight of nitrocellulose dissolved in sufficient organic solvent consisting principally of a mixture of lower aliphatic alcohols and acetone to make 1000 parts by weight of total reaction mixture, the amount of said chromium trioxide being less than the amount of said phosphoric acid, said composition being characterized by improved adhesion to metals and the ability to inhibit the corrosion of metals.

Fatty Alcohol Esters

U. S. Patent 2,801,934. Joseph W. Rizzo, Oceanside, N. Y., assignor to Chempatents, Inc., New York, N. Y., a corporation of Delaware.

A process for the preparation of controlled-viscosity synthetic drying oils which comprises reacting an ethylenic aliphatic monohydric alcohol of the type occurring in drying and semi-drying oils and having from 12 to 28 carbon atoms in the molecule and being substantially free of triply conjugated double bonds with a polycarboxylic acid compound selected from the group consisting of maleic acid, trimellitic acid, pyromellitic acid and the anhydrides thereof at a temperature in the range of 400 to 480°F. for a time in the range of 4 to 8 hours until the reaction mixture has a viscosity in the range of 2 to 70 poises, an acid number less than 10, and a hydroxyl number less than 16.

Titanium Dioxide Pigments for Baking Enamels

U. S. Patent 2,804,374. Guy C. Marcot, Lynchburg, and John P. Wikswo, Amherst, Va., assignors to American Cyanamid Co., New York, N. Y., a corporation of Maine.

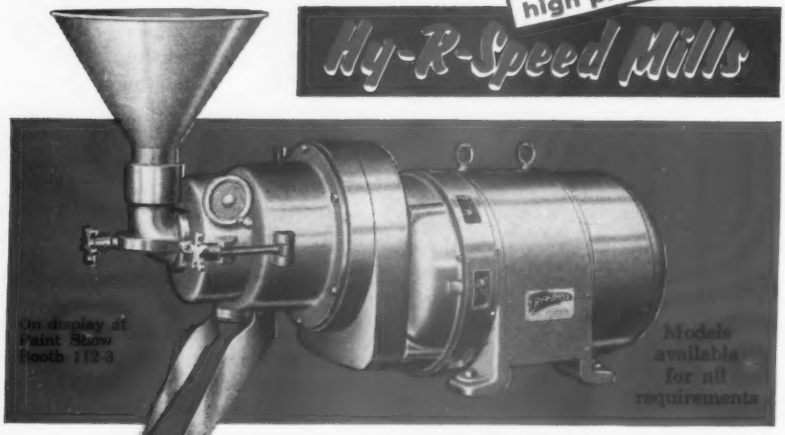
In a process for the production of titanium dioxide pigment by calcination of a water-washed titania hydrolysate, the steps of evaporating water from a water-washed titania hydrolysate sufficiently to form voids in said hydrolysate and insufficiently to increase the solids content of said hydrolysate to more than about 52% (calcined TiO_2 basis), and densifying the thus-dried hydrolysate until said voids are substantially filled.

Paint Remover Composition

U. S. Patent 2,802,790. Souren Z. Avedikian, Westchester County, N. Y.

A homogeneous creamy paint remover composition consisting of 730 grams methylene chloride, 80 grams methanol, 50 grams naphtha (flash pt. 105°F.), 25 grams methyl cellulose, 40 grams ammonium salt of sulfated castor oil, 20 grams paraffin (M.P. 124°F. to 145° F.), 200 grams 28 percent aqua ammonia, and 100 grams water.

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Heat-Resistant Finish

U. S. Patent 2,803,610. Bernard H. Kress, Toledo, Ohio, assignor by mesne assignments to Allied Chemical & Dye Corp., New York, N. Y., a corporation of New York.

A heat-resistant finish composition comprising an inorganic, heat-resistant leafing-type pigment dispersed in a solution, in a volatile, inert organic solvent having a boiling point below 200°C. and of the group consisting of aliphatic and aromatic solvents of (1) a rosin ester of a polyhydric alcohol, and (2) an acidic organosilanol having a molecular weight below 3000 wherein there are at least 2.5 silicon-bonded oxygen atoms per silicon atom, including at least 0.15 silicon-bonded oxygen atoms per silicon atom that are contained in hydroxyl groups; at least 70 percent of the silicon atoms have hydrocarbon substituents attached thereto; and at least one-third of said hydrocarbon substituents are aryl groups; the weight ratio of (1) to (2) being from 4:1 to 1:4.

Organopolysiloxane Polishes

U. S. Patent 2,804,440. Donald V. Brown, Schenectady, N. Y., assignor to General Electric Co., a corporation of New York.

A polish composition comprising by weight, (1) from 20 to 60 parts of a liquid linear methylpolysiloxane having a viscosity of from 50 to 1,000 centipoises, (2) from 2.5 to 20 parts of a liquid linear methylpolysiloxane having a viscosity of from 5,000 to 100,000 centipoises, the viscosities of (1) and (2) being measured at about 25°C. and the methylpolysiloxanes of (1) and (2) having a methyl-to-silicon ratio in excess of 2, the methyl groups being attached to silicon by Si—C linkages, (3) from 2 to 20 parts of a methyl phenylpolysiloxane resin incompatible with the aforementioned two methylpolysiloxane liquids, the methyl and phenyl groups being attached directly to silicon by carbon-silicon linkages and there being present an average of from 1.1 to 1.8 total methyl and phenyl groups per silicon atom, (4) from 15 to 45 parts of a microcrystalline wax, (5) up to 1,000 parts water, (6) from 25 to 300 parts of a finely divided abrasive, and (7) from 100 to 900 parts of a hydrocarbon solvent.

Starch-Clay Coating Colors

U. S. Patent 2,804,436. Daniel D. Ritson, Riverside, Conn., assignor to American Cyanamid Co., New York, N. Y., a corporation of Maine.

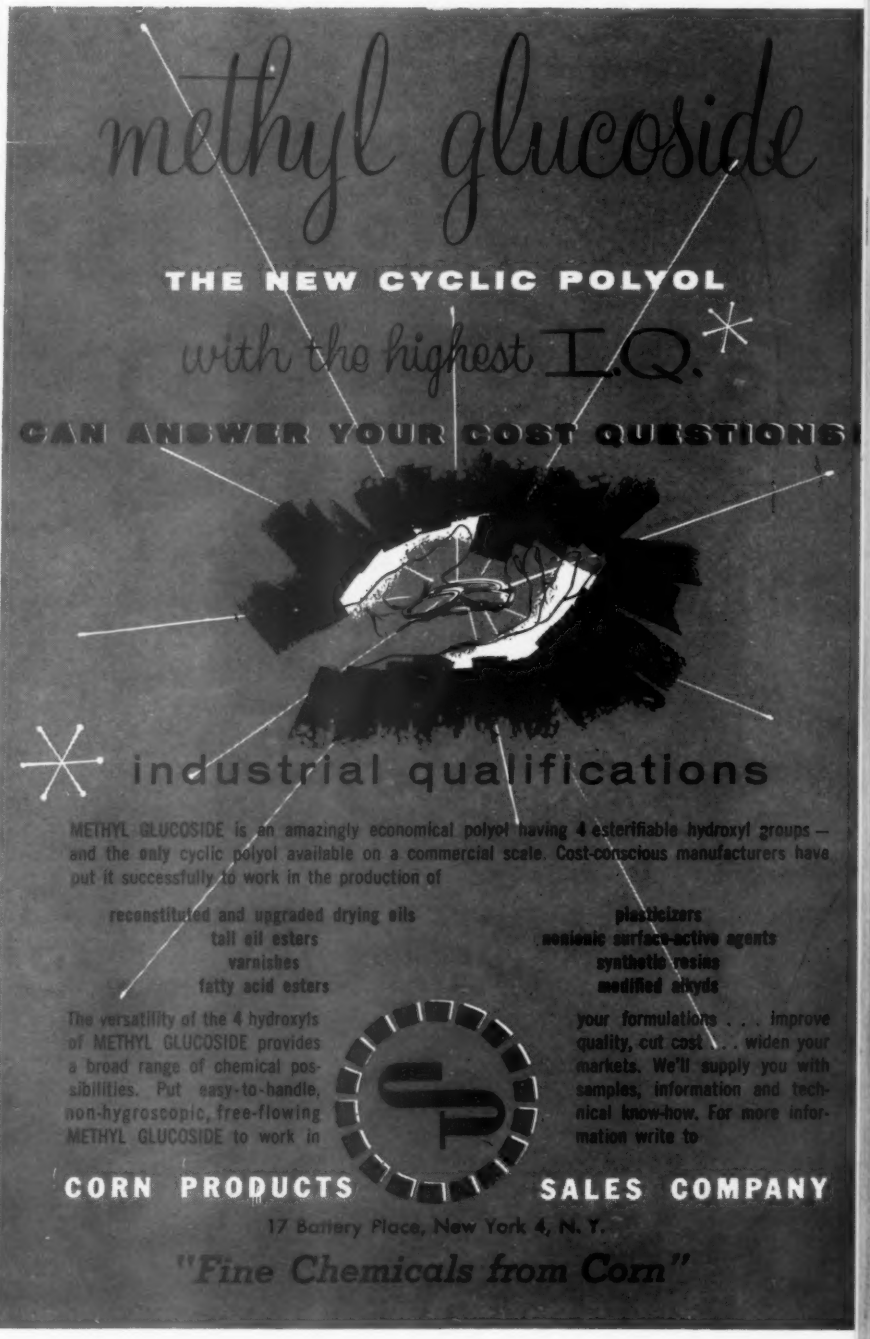
Replacement of half of the starch of the coating formulation by pure polyacrylamide or a high arylamide-low acrylic acid copolymer (colors A-D) gave coating colors which had undesirably high viscosities and which yielded poor wet-rub resistance values.

Antisweat Coating

U. S. Patent 2,804,437. Siegbert Katz and Siegmund Kut, Cardiff, Wales, assignors to Pearl Varnish Co., Ltd., Pontypridd, Wales.

An anti-condensation coating composition comprising by weight from about 10% to about 30% of a drying oil and phenol-formaldehyde condensate varnish from about 20% to about 50% of diatomite and from 0% to about 8% of a fibrous material, said varnish being emulsified in water.

LANCASTER, ALLWINE & ROMMEL
REGISTERED PATENT ATTORNEYS
•
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Patent Practice before U. S. Patent Office. Validity and Infringements Investigations and Opinions.



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GRADES	PARTICLE SHAPES	PARTICLE SIZES	OIL DEMANDS
XX-2	SPICULES MULTI-FACETS JACKS	MEDIUM	16
XX-50	SPICULES MULTI-FACETS JACKS	MEDIUM LARGE	15
XX-55	SPICULES MULTI-FACETS JACKS	MEDIUM	17
XX-503	ROUNDS	LARGE	11
XX-505	SPICULES MULTI-FACETS	MEDIUM LARGE	18
XX-601	ACICULARS	MEDIUM LARGE	14

LEADED

GRADES	WHITE LEAD CONTENT %	PARTICLES	OIL DEMANDS
Lehigh-6	35	CO-FUMED	12
Lehigh-61	35	BLENDED	14
Lehigh-635	35	ACICULAR	13
Lehigh-250	50	BLENDED	12

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abstracts



Mother of Pearl Finishes

by F. Margival: Peintures-Pigments-Vernis, Vol. 32, No. 5, pp. 441-442 (May 1956)

The author gives details of the pearl essence finish paints which have been known for some considerable time. These pearl essence finishes have remained particularly French, after having been originally discovered in Paris in 1656 by the Parisian Jaquin. Various modern improvements have been made on the original ancient process—thus, ammonia is added to the pearl "essences" which serves to ensure a better preservation. Again, the false pearls of hollow glass, after coating are filled with wax which gives weight and serves to improve the holding of the coating. Finally, a further development has been the incorporation of pearled particles in lacquers which give films impervious to water.

For a long time it was believed that the brilliant reflective particles were calcic compounds but it is now known that they are composed solely of crystallized guanine. This guanine, C-H-ON- is the excretion product of the live organism.

The manufacture of the pearl essence comprises the following operations: Energetic brushing or scraping under water of the treated fishes (sardines etc.), which gives an aqueous suspension of guanine crystals which carry superficially the fish scales; Coarse filtration through a bolting cloth and settling, followed by decantation of the clear liquid, then replacing in suspension in water and fresh settling. After decantation of the liquid, ammonia is added to the deposit and this is stirred in so that the proteins contained in the mass will dissolve up. The product is contained in bottles closed with glass or rubber stoppers; cork would be attacked by the ammonia with partial discoloration of the pearl essence.

This main type of treatment is subjected to some variations. Thus for the products which are destined to give a pearl lustre to cellulose mixtures, the guanine crystals are placed in suspension in acetone or in amyl acetate. The "essences" are graded into qualities according to the size of the particles in suspension—the larger, coarser fishes in general give more voluminous crystals than do the small size fishes. Some producers have succeeded in separating the smaller crystals from the larger ones, either by fractional sedimentation or else by passing through a centrifuge.

When the pearl essences enter into the composition of complex mixtures, due account must be taken of some incompatibilities. Particular care must be taken to avoid the introduction of agents such as heat, alcohol, formaldehyde, which could cause the coagulation of the proteins dissolved by the ammonia, which again would result in partial loss of the brilliancy. On the other hand, one must naturally avoid the employment of solvents of the crystals—caustic soda or potash lyes, hydrochloric, nitric or sulfuric acids. On the contrary, the following agents have no action on the guanine: ammonia, acetic acid and anhydride, organic acids in general and organic solvents. It should be noted that the crystals lose a part of their sheen when they are in suspension in pure water, the sheen being restored if traces of albumin or of ammonia are added to the suspension.



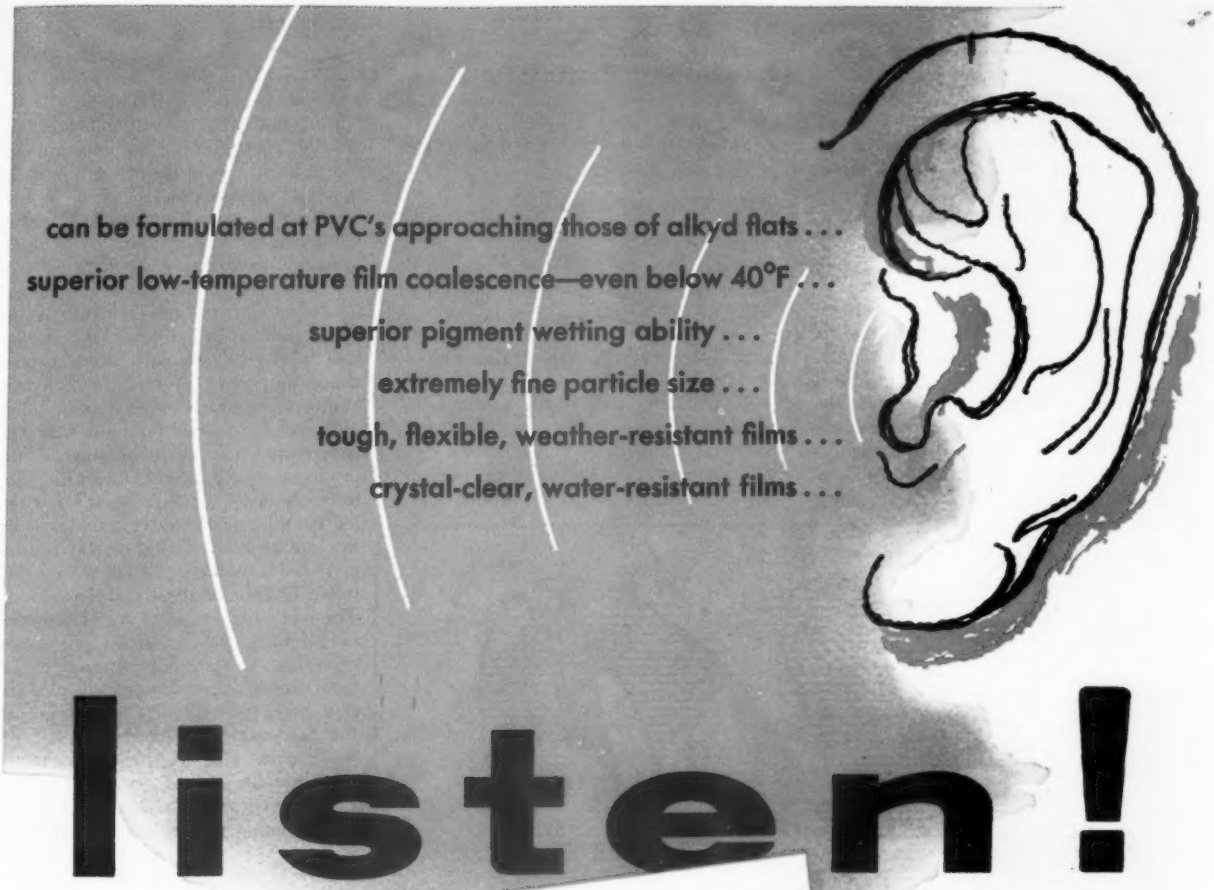
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- **It does not affect drying time or color durability.**

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Celanese emulsions produce tough, flexible, weather-resistant paint films that maintain their integrity, even after being immersed in water . . . they exhibit superior pigment binding capacities, with critical PVC's even higher than linseed oil . . . their fine particle size is the key to good tint retention and resistance to chalking, long required by the industry for more serviceable vinyl latex paints.

All this, plus the emulsions' low cost, mean greater efficiency and economy in the production of a far better, more competitively priced PVAc paint.

A Celanese Technical Representative will be happy to discuss the relative characteristics of Celanese CL-102 Homopolymer and CL-202 Copolymer and assist you with your interior or exterior formulations. Write for your copy of the free manual that shows you how to find the big difference in emulsions. Celanese Corporation of America, Plastics Division, Dept. 165-J, 744 Broad Street, Newark 2, New Jersey.

Celanese HQ not only stands for Highest Quality, but also for HeadQuarters for PVAc requirements. Celanese®

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Purification of the guanine crystals can be conducted in the following manner. The aqueous suspension of these crystals such as is given by scraping the fishes in water is freed from its undesirable proteins by digestion for about 48 hours in a mixture of 1 litre of the aqueous brew, 30 cc. of glacial acetic acid and 25 dg. of pepsin.

Purification of Standoil Gases

by S. G. Bogoslovskyi; Maslob Jir. Prom., Vol. 21, No. 6, pp. 27-28.

A description is given of an installation, which frees gases (formed by decomposition of vegetable oils) of their harmful and bad smelling components, by a repeated washing of the gas with cold water. The gases coming from the oxidizer and the cooking vessels are evacuated by a venting duct 45 metres long containing bronze spray nozzles producing a fine water spray which subsequently flows out by way of siphons into a pipeline leading to a decantation sump. The oil which is entrained is then separated and periodically recovered. To avoid the corrosion of the gas duct, the first sections are constructed of acid resisting stainless steel.

Paint Film Formation, Properties, Deterioration

by P. C. Blackmore: Paper presented at Autumn Congress of British Oil and Color Chemists Assoc.

The research conducted was spread over three different distinct domains of activity:

1. The preparation of a series of products capable of drying in air and relatively pure;

2. The establishment and the pursuit of 24 different projects, closely integrated, on the formation, properties and deterioration of paint films;

3. The detailed study of the results obtained during the course of this work and conclusions drawn.

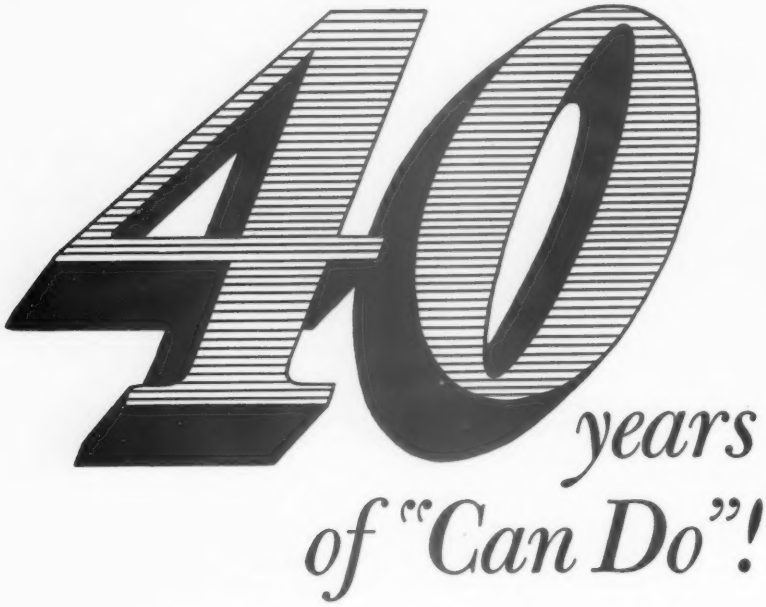
The different phases of this work are now terminated with the exception of the publication of the results, now in course of preparation.

The measures taken during the course of this research have been particularly centered on the increase in weight of the paint films, the variation of extensibility and the tensile strength, the absorption in the infra-red, the absorption in the ultra-violet, yellowing and the maintenance of brilliancy, permeability to moisture, porosity, the molecular weight of the products and the nature and the characteristics of the products of oxidation obtained. The research was conducted on 3 commercial filming mediums, as well as on samples of pure oils and of alkyd resins prepared from fatty acids of 95% purity (oleic, linoleic, linolenic and eleostearic). The oils were prepared by esterization of carefully isolated acids with pure glycerine, pentaerythritol and dipentaerythritol. The alkyds of phthalic acid were prepared by combining all the fatty acids available and all the polyhydric alcohols in all possible combinations.

The results obtained have served to cause doubts to appear concerning the theories generally accepted on the oxidation and polymerization of the oils. The results serve to suggest fresh domains of research. In the first place, after the deviations existing between the relative speeds of oxidation of the oils examined in appreciable quantities and those of the oils examined in thin films, one has been led to think that certain surface phenomena must play a capital role in the oxidation of thin films. These surface phenomena act not only on the kinetics of the process but equally and in an important fashion on the nature of the products, comprising the structure of the polymers resulting from the oxidation. Researches have been undertaken to determine the nature and the importance of these surface phenomena.

In the second place, it has been confirmed that during the passage of the film, from the tacky to the non-tack state, there is produced a slight diminution of the average molecular weights of the residual fatty acids furnished by the reduced and hydrolized film. It is necessary to examine the importance of this phenomenon of the diminution of the molecular weight and the role which it plays in the formation of polymers.

In the third place, it appeared that improved methods for the analysis of the oxidized films become necessary. In particular, it is indispensable to develop a suitable method for the



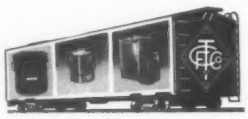
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precise measurement of the ether linkages. It is necessary similarly to improve the methods which are available for the determination of the importance of the hydroxyl and carbonyl groups.

In the fourth place, it can be mentioned that proof has been obtained that in the oxidation studies, the initial polymerization which is produced during the formation of the film causes reactions to intervene between the double conjugated linkages. Other studies have indicated that the polymerization of these structures leads to the formation of cyclic products. It is necessary accordingly to proceed to studies of the degradation of the films to isolate and determine the structure of the rings thus formed.

In the fifth place, it appeared that an important study should be undertaken, in the domain of the functionality. It appears of probable interest to study the formation of films of various mixtures containing variable proportions of non-functional molecules, mono-, bi- and trifunctional.

Initially, one could perhaps start from simple mixtures of di- and trifunctional molecules. The studies could cover the measurement of the absorption of oxygen, of the formation of conjugated dienes, of the duration of set, of the hardness, of the resistance to aging and in a general manner, of the collective properties of the films.

Finally, a program of research could be developed so as to determine the ideal proportions of saturated acids, of oleic, linoleic and linolenic acids which the ideal drying oil should contain.

The research which has been undertaken has been directed much more to base research than to applied research. It is only from research of this kind that one can hope to develop new and better products which are utilizable in the preparation of paints. Although these researches have not been conducted with an immediate technical aim, they nevertheless embody valuable indications of a general order. These indications applied practically, will justify the expense and time involved in carrying out this study work.

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Varnishing Products of Plastic Materials

by W. Oltze: Kunstoffe Rundschau, Vol. 2, No. 10, pp. 360-362.

Starting from the fact that the varnishing is practical and recognized as necessary for the finishing of plastic products, the author discusses the essential conditions to obtain success with this process. Details are then given of some methods of varnishing which have been found to give satisfactory results on the practical scale.

Severe conditions are encountered to obtain a one coat varnishing or painting which is brilliant and has good covering power by opacity, on wood and metal. These difficulties become still more pronounced in the case of the painting of plastic materials, which are nearly all sensitive to solvents. The majority of plastic materials of the thermoplastic type, such as Plexiglass, polystyrol, the polyamides, polyvinyl acetate etc. should, as much as possible, be treated with varnishes and paints which dry at ordinary temperatures.

Colorimetric Determinations on Phthalocyanine Pigments

by G. Ghisolfi: Ind. Vernici, Vol. 9, Nos. 7 and 8, pp. 181-183 and 203-205.

Colorimetric measurements were conducted on the following phthalocyanine pigments:

1. Copper phthalocyanine pigment, unstable to certain solvents;
2. Copper phthalocyanine pigment, unstable to solvents and treated by activated solvents:
3. Copper phthalocyanine pigment, stable to certain solvents;
4. Copper phthalocyanine pigment, stable to solvents and treated with activated solvents;
5. Copper phthalocyanine pigment, unstable in solvents and heated to 480° C.
6. Copper phthalocyanine pigment, unstable in solvents, heated to 480° C. and treated by activated solvents.

The colorimetric test shows that the influence of the active solvents on the unstable pigment is strong: the coloring power diminishes by more than 20%.

The milling of the pigment which has been subjected to the action of the solvents and pasted with a vehicle and a

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white pigment, does not sensibly modify the position; the coloring power remains irremediably compromised. The preparation of a pigment by means of a milling procedure in the presence of solvents and of a milling addition agent leads to a product which—although of good stability—is not however completely satisfactory, for the influence of the solvents is still appreciable; the coloring power diminishes by about 8%.

A thermal treatment of the unstable pigment, out of contact with air, induces a transformation of the pigment, which thus attains a complete stability to solvents. The pigment thus treated shows from the colorimetric point of view, characteristics which are found in the stable crystalline form (alpha form) of the phthalocyanine pigments.

Viscosity of Printing Inks

by D. Tollenaar: Verfkroneik, Vol. 28, No. 8, pp. 237-239.

With the aid of a bar viscometer of the Pochettinno type, the author studied the rheological properties of various printing inks, more especially as a function of the variation of the flow forces during the course of the printing. The plasticity diagrams obtained can be divided into three categories corresponding respectively to a behaviour which is purely Newtonian, to a structural viscosity and to a limit of flow which is more or less pronounced. The interpretation of these results from the viewpoint of the application of these inks in the various procedures of printing reproduction such as typography, lithography, rootgravure, etc. is then discussed.

The Garmsen Method for Testing Varnishes

by E. Recchia: Pitturi e Vernici, Vol. 11, No. 11, pp. 707-712.

The author discusses briefly the method of formation of films of variable thickness according to the Garmsen method. This method permits of obtaining films of 0 to 100 microns in thickness and of referencing exactly on the test part the point corresponding to a given thickness and regarded as optimum for the execution of a given test.

Precise details are given of the various types of test capable of being practised under good conditions in this manner: milling fineness of the pigment, measurement of the expansion, drying time, brilliancy, covering power by opacity, hardness, adherence, elasticity, resistance to scratching. A suitable equipment is finally described which assembles all which is necessary to practice these tests.

Cuprous Oxide in Anti-Fouling Paints

by M. Montorfano: Pitturi e Vernici, Vol. 11, No. 9, pp. 587-588.

The effectiveness of this important toxic agent which is largely utilized in the preparation of anti-fouling underwater paints is closely associated with its content of cuprous oxide, to the exclusion of cupric oxide and of metallic copper. These two latter must be considered as dangerous impurities.

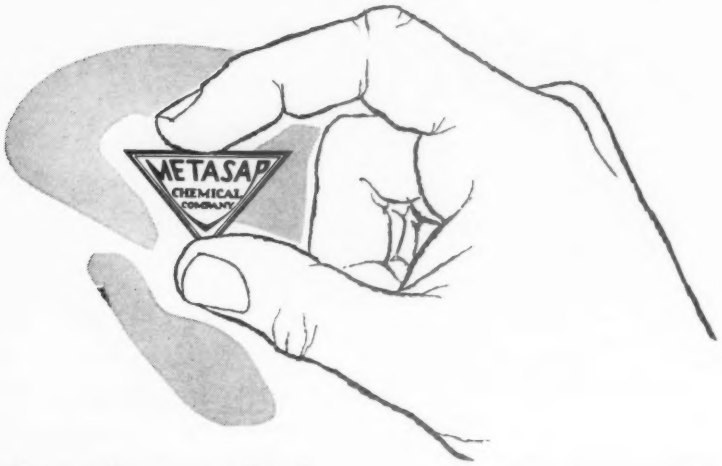
An optimum commercial product should contain at least 97% cuprous oxide and a maximum of foreign metals not exceeding 0.5%. The specific gravity should be of the order of 5.85. In addition, the loss of reductive power after 72 hours at 40° C. and 95% relative humidity, should not exceed 2%. Finally, the insoluble residue in nitric acid should be of the order of 0.1% to 0.3%.

Anti-Corrosion Paints for Marine Applications

by A. P. Poggi: Pitturi e Vernici, Vol. 11, No. 9, pp. 583-586.

The author outlines the principles which must be followed so as to realize a correct application of the anti-corrosion varnishes. The application details will govern to a large extent in actual fact, the effectiveness of the coating. An essential problem is that of the adherence of the protective film. To achieve this, careful surface cleaning is necessary and the formation of a suitable sub-surface condition by the employment of phosphatization or wash primers. The anti-corrosion pigments which can be employed are relatively

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These pigments are often employed as a mixture in a filming agent of the linseed oil type; glycero-phthalic resin; oil-reacted phenol resin, cooked with wood oil; glycero-phthalic resin modified with vinylic co-polymers, epoxy resin esterized with fatty acids; vinylic co-polymers.

Single Coat, Anti-Rust Protective Paint Systems

Chimie des Peintures, Vol. 18, No. 10, pp. 359-360.

As a result of high cost of labor at the present time, the tendency now is to replace the older classical systems of steel protection by the application of three or four coatings which up to now have been regarded as indispensable in Europe, by a single coat application procedure.

The essential property to obtain from the filming agent is impermeability. Among the base products which can be utilized there can be cited: the synthetic rubbers, certain derivatives of polyethylene, the vinylic co-polymers, the Epon resins, benzyl cellulose and certain bitumens.

It is necessary to add special agents to each of these materials, destined to confer some particular property to the coating such as to augment the adherence, ensure stability, avoid the migration of the plasticizers etc. The application of a paint in a thick coating by spray gun application is a fairly delicate operation and the preparation of the base surfaces requires a quite particular care.

Constructional Steelwork Protection in Gas Industry

by L. A. Rawald: Chemistry and Industry (G. Britain), 1955, No. 48, pp. 1526-1535.

The author recommends exposure of the steel before painting to the weather and then to subsequently remove the roll scale by a mechanical treatment.

One can thus do this by a flame cleaning treatment and then conduct a phosphatization or a flame metallization of the surfaces. In the case of a metallization treatment it is necessary to avoid the use of metals such as zinc which are attacked by the gases in the atmosphere of gasworks.

The primer coating which is subsequently applied is constituted generally by a red lead paint on linseed oil. The paints are applied most usually by spray gun but brush application is preferable as it ensures a better adherence. In general, on new constructional steel work exposed to the weather, four coats are applied. These are two coats of red lead primer paint, an intermediate coating and a finishing coating of the desired shade.

Formerly zinc oxide was used in the surface coatings; this is now replaced by titanium oxide of the rutile type. The silicone varnish paints are applied on surfaces which are intended to be heated and the bituminous coatings on surfaces exposed to moisture. The paint employed for gasometers varies according to the type. The same holds good for condensing equipment, cooling towers and boilers.

Protective Painting for Constructional Steel

by G. Dechaux: Chemistry and Industry (G. Britain), 1955, No. 48, pp. 1535-1541.

The work is divided in three parts:

1. Study of the corrosion of painted steel constructional work. The methods of protection to be adopted then evolve from this study;
2. Formulation of anti-corrosion paints;
3. Methods of appraising the effectiveness of anti-corrosion paints.

The author examined in particular the action of sea water and arrived at the conclusion that a painted surface, as a result of the pores of the paint film behaves as a non-coated surface and that the electrical phenomena are analagous to this.

As regards what concerns the formulation of the anti-corrosion paints, the essential objective to attain is the impermeability of the film. This impermeability depends on the thickness of the coating, on the nature and on the texture of the pigment, on the proportion of pigment and of filming agent as well as on the reactions between these two constituents.

The duration of the effectiveness of a paint is measured by the time during which it remains outside the reach of corrosion.





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It is necessary in addition, to evaluate the cost of the protection obtained, taking into account the choice of the method of surface preparation and of the nature of the paints employed.

Painting and Protection of Constructional Steel

by F. Fancutt: Chemistry and Industry (G. Britain) 1955. No. 47, pp. 1492-1502.

The following conditions must be fulfilled by a protective paint applied after cleaning of metallic surfaces:

1. Cost not excessive.
2. Inexpensive application.
3. Should not present any obstacle to the constructional work.
4. Possibility of through-welding.
5. Should not be susceptible to deterioration by piercing, scraping etc., during the erection.
6. Facility of repairing after possible deterioration.
7. Effective protection of the metal over a period of more than twelve months after which the coating should be able to be repainted without new preparation.

The preparation of the surface can be effected according to five procedures: cleaning by hand, mechanical cleaning, chipping, exposure to weathering, flame scarfing.

The primary coatings should be chosen as a function of the utilization of the work.

Good Painting Practice for Constructional Steel

by J. Bigos: Chemistry and Industry (G. Britain), 1955, No. 47, pp. 1503-1510.

After detailing the causes of the corrosion of iron and steel the author then reviews the different utilizations and forms of constructional steelwork:

1. A large part consists of steel framework covered by masonry and providing a building incorporating flats, offices, shops and hospitals. The steel surfaces which are carefully cleaned, then receive a coating of a primer paint which is not too costly, which is intended to protect the steel surface for a period of six months, during the course of the progress of the constructional work.

2. A second category is that of steel which is exposed to the air inside the building. The exposure conditions of the metal in these works is generally not very severe.

3. A third category comprises those for factories where the service conditions can vary greatly according to the type of manufacture being carried on.

4. A fourth category comprises constructional work exposed completely to the weather (bridges, dam superstructures, external resevoirs, water towers etc.).

5. Finally, a last category groups those steels exposed to particular severe conditions; these are constructions immersed in salt water or exposed to the action of chemical agents.

The following are abstracts of papers presented at the October, 1956, meeting of the Deutschen Gesellschaft fuer Fettwissenschaft at Hamburg, Germany.

Use of Gas Chromatography in Oils and Fats

By A. T. James.

Details of a process are given, which renders possible the separation and testing of practically all fatty acids in amounts of a few mg. up to 50 grms; this is very difficult with all existing methods hithertoo available.

With this the fatty acids are investigated preferably in groups of each C_1 to C_6 and C_6 to C_{20} and the fractions are indicated by recording instruments. The columns used have quite a long life duration, and according to details given by the author, can be used for many hundreds of determinations. The method is obviously applicable also to the investigation of natural fatty acid mixtures. In addition, the method has been fruitfully applied to structure elucidation. It can accordingly be considered with this, that gas-chromatography will soon become an important investigational and determinative method in the fat and oil industries.

New Application of the Epoxy Resin

By J. J. Zonsfeld.

The author gives details of printing inks based on the epoxy resins. The advantage of these lies in the fact that they require only a small amount of solvent medium and dry rapidly after



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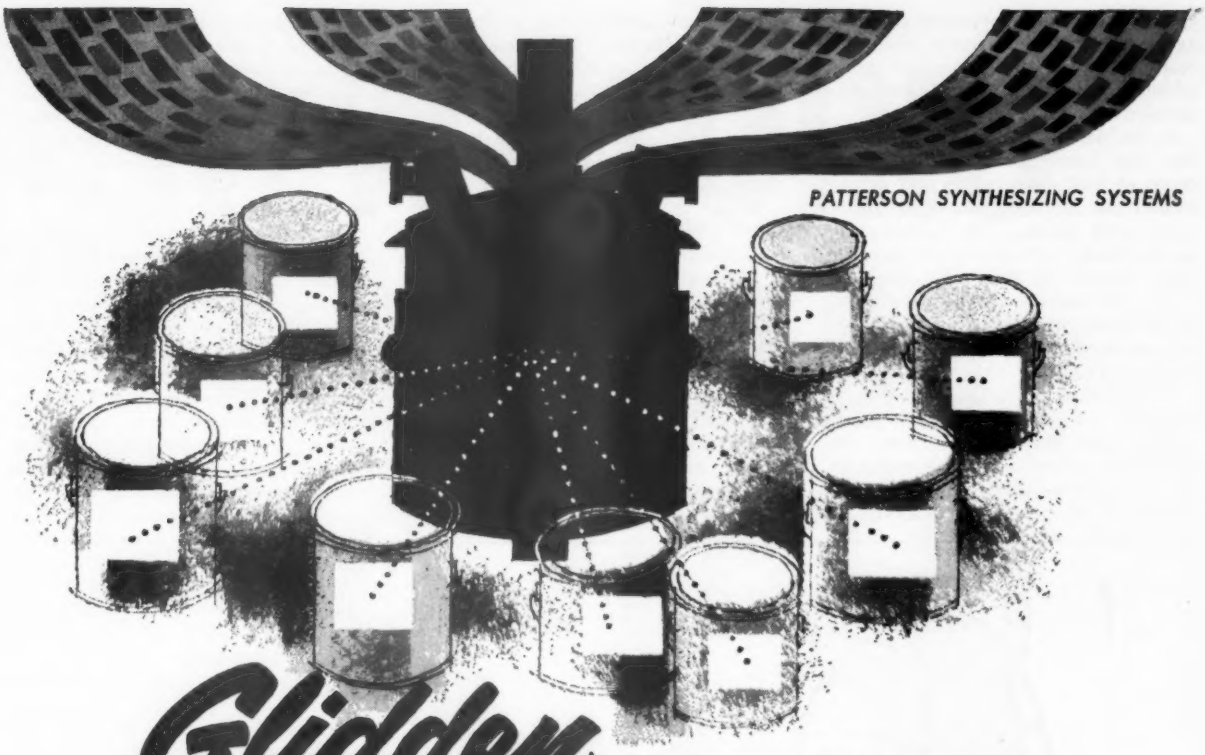
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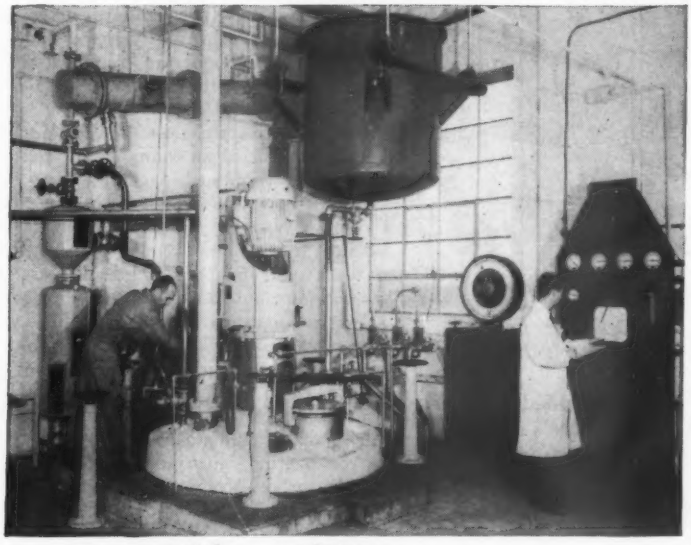
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application. The necessary filming agents are available over a wide viscosity range. With the co-use of amine adducts, paints of a good water-resistance are obtained.

In the paper, there are considered on the one hand, solvent medium-free esters of fluid epoxy resins and on the other hand, the hardening of the epxoy resins with amines. By esterification of the known epikote 834, for example with linseed oil, soya oil, castor oil fatty acid, solvent medium-free esters of the first type are obtained. These are outstandingly suitable for the production of printing inks.

The hardening with amines and with mixtures of long-chain alkyl monoamines and poly-amines allows the formation of epoxy resin films, which are more water-resistant than those obtained up to now. The stability towards solvent mediums can at times be somewhat reduced. The tests, which can be regarded as not yet concluded, serve to show that the mixture ratios, for example for stearyl amine, octyl amine or ethylene diamine, influence the subsequent characteristics very considerably.

Paint and Lacquer Testing

By G. Zeidler.

The work in this direction of Toeldte and Merz is first discussed and it is indicated that the translation of physical fundamentals and chemical knowledge into terms of lacquer testing is quite a complex matter, if data for paint and lacquer characteristics is to be developed from these laws. Uniformity and reproducability of lacquer test methods leaves much to be desired in actual fact.

The characteristics to be tested are mostly of a complex nature and the testing equipment available and in use, which runs to about 200 different types, only serves to add to this complexity. The author considered briefly the chemical side of the testing. With this, the determination of the esterification speed plays a great role.

The physical test methods used for paints and lacquers were then dealt with in great detail. The author has had great experience in this field and was able to make a valuable contribution to the subject. The following fundamentals were discussed: the flow law, the diffusion law, Stokes law and analytical characteristics such as the saponification number, the boiling point behaviour and solid body determination. These characteristic fundamentals only become practical and usable for normal lacquer testing if the constants so obtained are regarded as complex.

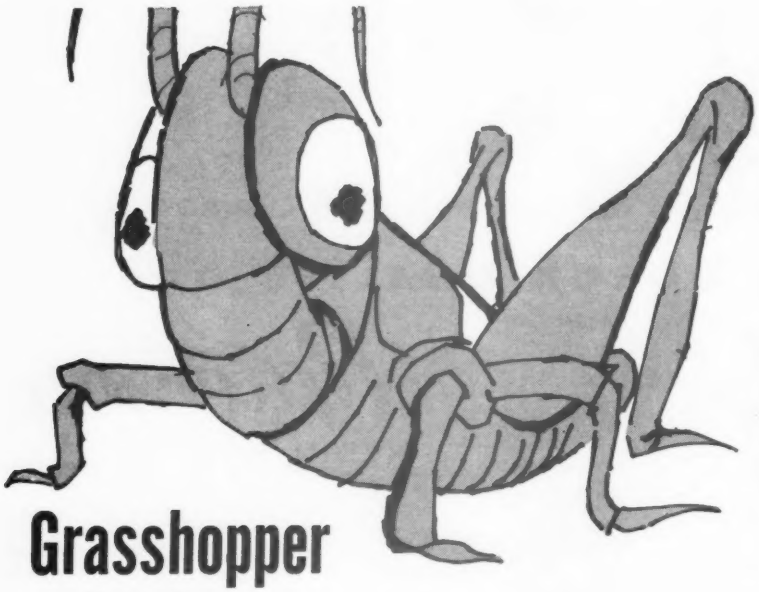
In practice, such important conceptions as hardness and viscosity can be more easily signified if the relaxation period is incorporated. With the technico-measuring appraisal of paints and varnishes, this leads to an increasing preference for the torsion principle, with viscosity measurements as against the flow principle and for the measurement of the oscillatory damping as compared with other conventional test methods for the hardness determination. This can have as a result, a leading to a simplification of the standard determinations with paint and lacquer testing, which at present are complicated and accordingly have become time-consuming. This is so, because the individual characteristic values are not always recognized as complex material constants. With such a consideration, it becomes also evident, that the striving towards standardization of testing methods must remain unfruitful until it embodies the standardization of the important test apparatus.

For the investigation of lacquer films, the ascertainment of viscosity, thixotropy, etc. is not alone determinative. For a more uniform designation of characteristics, determination of the flash point range (2 test procedures), of the melting range and the application of turbo-viscometers is much more decisive. Characteristic values obtained in this way then give a uniform, all-inclusive picture.

Quantitative Determination of Linoleic and Linolenic Acid

By C. Franzke.

The varying solubility of the bromine addition-products of linoleic and linolenic acids in petroleum ether at 50° C. was used by the author for their quantitative determination. For this purpose the bromine was allowed to act on the fatty acids in ethereal solution.



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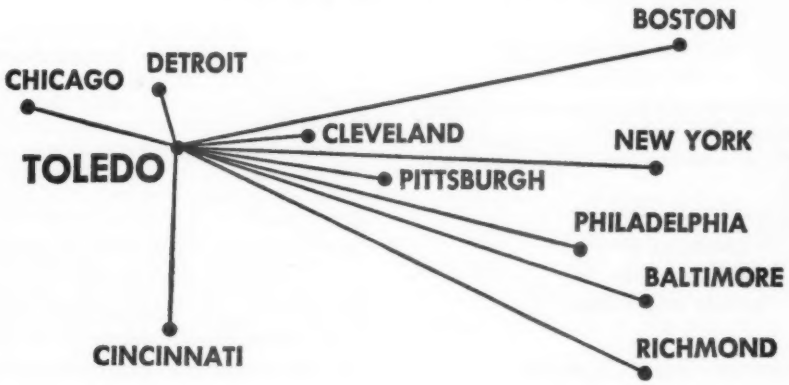
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Pigmentation of Polyester Lacquers

By K. Heinle.

The author first discussed the outstanding lacquer-technical characteristics of the colorless lacquer polyester resins and then proceeded to discuss in greater detail the corresponding pigmented, single coat lacquer systems, which with correct preparation, are just as hard, brilliant, polishable and buffable.

The polyesters are one of the most recent raw materials available to the paint industry, and find application particularly in the field of wood lacquer finishes; the polyester resin, which is used for processing is almost exclusively in the non-pigmented form. Although the application of this resin is today still disputed and quite often overvalued, the fact remains that it will secure a firm position in coatings for glass plates (instead of, for example, wood). As inexact figures are given with higher values, the lacquer coating should be thin. The extent of the pigmentation used is extremely important, (generally 10%) and detailed tables on this are given. For hardness testing, uniform coatings of 100, 200 and 400 microns were applied on glass plates.

The pigment absorption capacity of these resins is relatively small. It is only after the testing of all film characteristics that the optimum pigmentation can be established. Tables presented showed the influence on hardness, brilliancy, polishability and buffability, covering power and oil requirements of the individual pigments in respect to the polyester resins. Finished coating examples served to show what good surface characteristics are to be attained with correct pigmentation. The light and weathering characteristics of the pigmented finishes also were found to be satisfactory.

The biggest application of the polyester resins will undoubtedly be the non-pigmented application. Nevertheless in conjunction, a pigmented application will also meet a definite need and will serve to cover further application possibilities for the material and to utilize further its undoubtedly good characteristics.

Although the technique is not fundamentally new, apart from the processing skill, the choice of the pigments is decisive. The color scale which is now available on the basis of the most recent research work is very extensive, as was shown by color plates.

The good gelling characteristics and the great hardness of the polyester resins signify, to a certain extent, a superiority over the polishing lacquers known up to now. The choice of pigment here is of particular importance and at the moment, all color tones are not available for the purpose.

The hardening reaction should not be influenced in any way by the pigment, for with an acceleration of the hardening, the storage and keeping characteristics suffer, and the finished coating suffers embrittlement before its time. If, however, the pigments retard the hardening, then the finish coatings only harden-out incompletely and the buffing and polishing characteristics of the coating suffer.

The chief technical features to be considered with the pigmentation are the hardening curves, including the end hardnesses achieved, as well as grain hardness, texture and type of particle of the pigment. The first of these should be neither influencing nor actually disturbing.

Polarographic Determination of Driers

By M. Bernard and H. P. Kaufmann.

Details were given of comprehensive polarographic determinations obtained with drier substances used in paints and varnishes. With this method, the older classical chemical determination method of ashing, with all its undesirable difficulties, becomes obsolete. Conductive salt solutions of a quite definite composition were prepared by the authors with potassium acetate, and with these it was possible to test with great certainty, the drier substances both qualitatively and quantitatively.

The comparative potential values for the most important metal compounds in this connection were determined. These run for example as follows:

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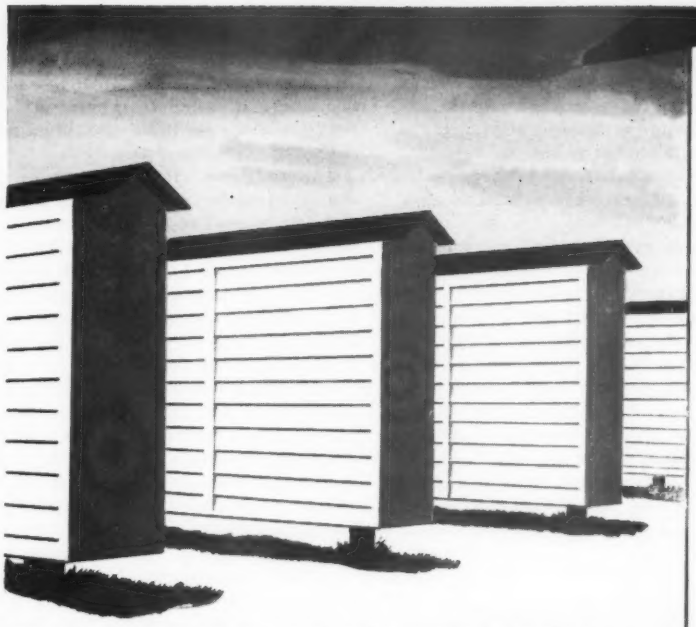
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lead to 0.64 volts, cobalt to 1.41 volts, and manganese to 1.8 volts.

These values permit smooth determinations, for example of lead and cobalt, or of lead, cobalt and manganese, side by side. With this, an outstanding agreement was found with the values ascertained gravimetrically. The chief advantages of the polarographic test method are the rapidity and exactitude as well as the fact that the results can be reproduced as curves.

Cadmium Cinnabar— A New Class of Pigments

By H. Pfleiderer.

The author first gave a survey of the possible future, fairly wide field of application for this product. Also discussed were the requirements which are imposed among others, by the plastics industry, as regards light fastness and resistance to acids and solvents, especially with the red pigments.

Cadmium red, which is a mixed crystal of cadmium sulfide-selenide, fulfills these requirements, but is very expensive, particularly on account of its selenium content. The cadmium cinnabar pigment has been developed in the search for a substitute material which is less expensive. X-ray testing, of which a series of comparitive photographs were taken, makes evident the presence of corresponding cadmium-mercury sulfide mixed crystals.

The pigment has been termed cadmium cinnabar, but the color tones are not limited to that of cinnabar. Actually, according to the mixture ratio employed, all color tones from bright red to the darkest maroon are producable. The color tones obtained range according to the composition of the pigment—on the average 10 to 20% mercury sulfide, the rest cadmium sulfide—giving the whole range from the brightest orange to the darkest red-brown.

The cadmium cinnabar pigment is characterized by a high coloring power and also a good covering power. The heat resistance is so great that resistance to temperatures of 200° to 300° C. for example, for stoving lacquers, appear to be possible. The pigment cannot be used in ceramics because the mercury sulfide sublimes at 580° C.

This pigment is alkali resistant, and also to a certain extent acid resistant (with the exception of strong mineral acids and the like). It also resists solvent mediums and does not "wander" out of the finish. These new pigments should be equivalent to cadmium red in covering power and brilliancy, oil absorption, light-fastness and heat resistance. The cadmium cinnabar pigment is not poisonous in spite of its mercury content. This question of toxicity is, of course, technically important. It was pointed out that one has to consider this matter by stages. With the finished product ready for use, the question of a true toxicity does not arise; mercury sulfide pigment itself at this stage is not toxic. With the manufacture of the pigment and paint medium incorporating this, naturally the normal precautionary measures should be observed.

Thixotropic Alkyds

By L. Erlandsen.

The author first gave a survey of the patent literature on thixotropic alkyds, which serves as a comprehensive picture of this development. Thixotropic masses are those, which under the influence of the shearing forces generated on stirring, change their viscosity characteristics and then, after a certain time, return to the initial condition. It will be obvious that these characteristics are very favorable and highly valuable to finishes, as the paint will be solid in the can at rest. Only after stirring with the brush will the paint become fluid (again to solidify with renewed standing).

The author showed that the gelling alkyds, which are obtained from polyamides and alkyd esters according to the following:

$$R \cdot COOH + R' \cdot CO \cdot NHR'' \rightarrow R' \cdot COOH + R \cdot CO \cdot NHR''$$

$$R \cdot OH + R' \cdot CO \cdot NHR'' \rightarrow R' \cdot COOR + NH_2R''$$

$$R'' \cdot NH_2 + R \cdot COOH \rightarrow R \cdot CO \cdot NHR'' + H_2O$$

are of special significance in the above case and that the (around 25) Gelkyd patents which cover these, contain not less than 193 patent claims.



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The cause of the thixotropy lies presumably in the H linkages at the N bridges of the polyamides. The production and uses of the gel finishes, for example as a non-running household paint, and of soya or linseed oil alkyds, are closely covered by patents and licenses. Special gel testers are used for the viscosity measurements incorporating a balance system and based on the Boucher gel tester used in the glue and gelatine industries.

The original unwanted phenomenon of thixotropy, with paints and varnishes, has in the course of time, allowed certain advantages to be recognized. Today this is utilized quite often to a great extent and is intentionally induced to a certain degree. Correctly regulated, thixotropy can improve the flow of the paint and delay sedimentation and bottoming. For this purpose the author used ester-modified polyamide resins, alkyd-type filming mediums termed gelkyds in Germany. These are able to produce a high thixotropy.

Relationship Between Plastics and Lacquer Raw Materials

By R. Hilpert.

Both types appear to be identical, and the deviations can be recognized in the main, in the apparative and processing viewpoints. This was shown in detail with the Buna lacquer raw material. The chief difference is that plastic is an independent material. A lacquer raw material, on the other hand, being used as a film, is not an independent substance.

The boundary between the two materials is, however, somewhat a fluid one, particularly with the hot spray process for plastic application. This may, in some ways, be regarded as a purely plastic processing operation. From another viewpoint, it can be termed a lacquering process. The methods of working, both of the plastics and of the lacquer processing industries, are practically the same.

Application of Bentones in Paint

By K. E. Hofstadt

By the term Bentones is understood reaction products of sodium bentonite, which is a derivative of the montmorillonite group, thus, the end group of an aluminum hydro silicate, for example, with alkylamino hydrochlorides. In this way, interesting and manifold organic bentones are obtained, which are able to swell up to a considerable extent to thixotropic gels and can accordingly be quite important for finish industry techniques, as well as on account of their thermal and special stability.

The spreadability and flow of the paint incorporating this product is considerably improved. The aging and storing stability is ensured, and the acid and the alkali resistance is increased. These bentones may be regarded as alkyl-ammonium bentonite. The swell characteristic of the product rises with increasing hydrocarbon content. The specialized application of these products, according to the author, is to raise the viscosity, to improve the spreadability and to hinder floating and sedimentation of the pigments.

The application is conducted either by addition to the pigments before the milling, or by the addition of a gel of bentone in a solvent medium after the milling. As always with mediums of this type, the optimum content, which in general lies between 350 and 400 grm. per 100 kg. of paint, should be first ascertained. This is dependent to a large extent upon the nature of the pigment, its concentration, the nature of the filming medium used and the nature of the solvent medium present.

Production of paints incorporating bentones is conducted at an elevated temperature, with the addition of polar mediums to the filming agent, plasticizers or similar agents for lacquers. For processing with ball mills or roll mills, it is most favorable to produce a pre-gel with 20-25% of bentone and to add this to the pigment system or similar system.

About 300-400 grms. of bentone per litre of pigment addition will provide a "non-bleeding," stable finish, which works well and which will give neither tears nor runs. The application of this special finish for road marking purposes needs to be specially mentioned. The penetration capacity of the bentone-paint mixture into porous substances is increased. On the other hand, the bentone additions exert hardly any appreciable influence upon the evapora-

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tion of the solvent medium. The viscosity is increased.

The development of this product and its applications is still in course of progress. As compared with the products obtained up to now, an almost colorless bentone, of which full details are not yet available, has only just recently been produced.

The bentones are thermo-stable to a great extent, although this is of no interest with a suspending medium as such, because such a medium has fulfilled and ended its functions with the formation of the finish film.

Use of Colorimetry for Measuring Drier Action

By J. Morgner.

The author gave details of the test method developed by him in conjunction with W. Sutor. The method was used in a comprehensive research for the clarification of the chemistry of the reactions occurring with oxidative oil drying. The authors ascertained the heat effects which are given with the catalytic splitting of the hydroperoxides as well as of the blown drying oils and of blown terpentine oils.

The heat modification with the action of the known metal driers was ascertained and an action scale was prepared in the series cobalt, manganese, copper, lead, iron, calcium and zinc. The series order established by ascertainment of the driers action, could be confirmed in this manner. According to the methods described therefore, a judgment can be obtained of the action of any desired metal on the oxidative drying oils.

It is all the same whether the test oils are made up on a basis of blown oils, based on linseed oil, or of terpentine in the presence of cobalt driers. The auto-oxidative drying with hydroperoxide formation always proceeds with the disengagement of heat. This heat can be measured by means of a sensitive calorimeter. In this way it can serve as an effect comparison, for example for the resin acid salts of cobalt, manganese, lead, etc. Up to now, other acids have not been researched by this method. With the series order of effectiveness given above, cobalt is the most active member of the series, in each case 0.4 equivalent percent of metal being added to the test oil as resinate. After some standing of the fresh test batches, the determination method leads at first to constant values, which then gradually sink in a noticeable manner, if the metal salts begin to catalyse the hydroperoxide decomposition in an accelerative manner.

Particle Size Distribution of Pigments

By A. Goeb

It was first shown how the particle size and the particle shape of pigments influences the rheological (flow) characteristics of paint and varnishes. With mention of this, the average particle size is actually meant, which in general is an average figure obtained from all particle sizes between 0.1 and 20 microns. This is, however, conditioned by production.

The production of pigments of uniform particle size is a difficult matter, particularly if the pigment paste must be dried after its preparation, so that the advantage of the monodispersivity by agglomerate formation is again cancelled and can no longer be produced by the subsequent milling. The use of protective colloids and wetting agents can only partially help here.

The varying particle sizes were demonstrated by lantern slides, with among others, coarsely dispersed chrome orange, finely dispersed molybdenum orange, mono-dispersed lead white and various types of red lead.

The pigment particle size is obviously of significant importance to the lacquer characteristics. With the not necessarily correct assumption of a spherical shape for each particle and an average size of these, the author indicated the distribution of the individual grain sizes by means of curves. The theory of the formation of pigment particles from solution was discussed in detail.

In the laboratory, it is possible to produce mono-dispersed pigments (white lead, red lead, chromates) in the fluid as also in the vapor phases. With this, it is only necessary to remove the crystal particles once they have formed, immediately from the formation space. This before they have grown to still

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	Spec.	Typical	Spec.	Typical	Spec.	Typical	Spec.	Typical	Spec.	Typical	Spec.	Typical
% Metal	23.9 24.1	24.0	5.9 6.1	6.0	5.9 6.1	6.0	3.9 4.1	4.0	7.9 8.1	8.0	7.9 8.1	8.0
Viscosity (Gardner)	A Max.	A-1	D Max.	B	J Max.	F	H Max.	G	Z Max.	W	A Max.	A-2
% Non-Volatile	68 Max.	67	65 Max.	60	70 Max.	67	60 Max.	55	80 Max.	78	55 Max.	53
Lbs./Gal. (77°F)	9.65 9.80	9.72	8.05 8.25	8.17	8.09 8.29	8.19	7.70 7.85	7.77	8.50 8.75	8.65	7.95 8.10	8.00
Specific Gravity (77°F)	1.158 1.176	1.167	0.9675 0.9916	0.9820	0.9723 0.9963	0.9843	0.9244 0.9424	0.9327	1.020 1.050	1.038	0.9544 0.9723	0.9604
Bulking Value (77°F) (Gal./Lb.)	0.1036 0.1020	0.1028	0.1242 0.1212	0.1224	0.1236 0.1206	0.1224	0.1298 0.1274	0.1287	0.1176 0.1143	0.1156	0.1258 0.1235	0.1250
Color (Gardner)	9 Max.	8	Blue-Violet		16	15	9 Max.	8	Emerald Green		7 Max.	6
Solubility (77°F) Mineral Spirits 1:10	No Cloud For At Least 96 Hours						Permanently Soluble		No Cloud For At Least 96 Hours			

MATERIAL												
% Metal	K Max.	5.9 6.1	6.0	72 Max.	0.9984 1.020	1.002	K Max.	0.1219 0.1176	0.1198	Dark Brown		
Viscosity (Gardner)												
% Non-Volatile												
Lbs./Gal. (77°F)												
Specific Gravity (77°F)												
Bulking Value (77°F) (Gal./Lb.)												
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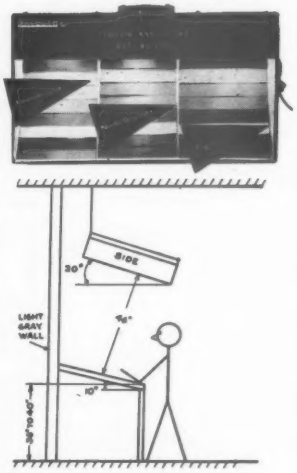
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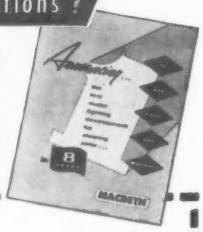
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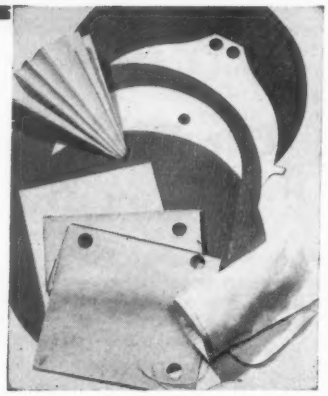
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coarser particles. The large-scale methods of achieving this (for example, with the co-use of protective colloids) were indicated.

The production possibilities for mono-dispersed pigments are today still very limited. With the use of protective colloids, disturbing substances of a foreign nature are frequently passed into the paint finish, so that preferably they should find application merely for printing inks. On the other hand, the "flush technique" of pigment production offers the possibility today, both in the paste form as also with dry pigments, of producing mono-dispersed pigments of a high degree of fineness. By envelopment of the individual particles in soft resins, hard resins, plasticizers, waxes or high molecular substances, the best suitable type of coating envelopment can be ascertained for each application purpose.

Naturally, the particle size determination plays a decisive role for such methods and purposes. It can be conducted by counting under the microscope or electron microscope, but the sedimentation analysis is more convenient, although it requires more patience and time. In the form of the sedimentation balance, the method has been found satisfactory from every aspect, particularly because it allows definite statements on the quantitative particle size distribution. The sedimentation balance which is provided with a mirror and a selenium cell, makes possible an insight into the particle size distribution. A disadvantage of the count by the optical microscope method is that a small part of the test field is covered; an advantage is that conclusions can be simultaneously drawn regarding the shape of the pigment particles.

Comparison of Viscosity Determinations

By C. Boller.

The author undertook the valuable task of ascertaining comparative steps for the viscosity values obtained by so many different processes. This work was sponsored by the German Paint Research Association and the particular value of this research resides in the fact that it is only by this investigation that it will be possible to place in strict relationship to one another the viscosity values obtained by all the different measuring methods.

The author gave brief mention of the conceptions of the absolute, the kinetic and the dynamic viscosity and of the chief types of apparatus used for viscosity measurements in various countries.

The comparison scales, which are based on a density of 1 and a temperature of 25° C., were presented in the form of six tables. It was considered that the elaboration of these tables subsequently would be desirable. Multiplication factors permit further cross-calculations. The use of a table for conversion of seconds into poise values and inversely, was mentioned.

With these tables it is possible to read off the relationships between the different viscosities and the absolute viscosities. The viscosity values ascertained according to the various determining methods are so presented, that a rapid orientation and re-calculation of the viscosities found into those sought, is possible.

Auto-Oxidation Speed of Unsaturated Fatty Acids

By E. Gulinsky.

The tests were conducted under precisely the same conditions at 20° C. and proved that auto-oxidation proceeds most rapidly with the acid chlorides: on the other hand, the slowest with the amides. The esters and acids occupy an intermediate position.

The curve diagrams shown for the corresponding derivatives of alpha and beta eleostearic acid confirm the conclusions drawn. With this, it is of further interest that the alpha derivatives react more slowly than the others. The reason may lie in the stereoisomeric molecular structure.

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NPVLA Meeting Features Slate of Top Speakers

Senator Wallace F. Bennett of Utah and Secretary of Commerce Sinclair Weeks are to be among the speakers at the 70th Anniversary Meeting of the National Paint, Varnish and Lacquer Assoc.

The Meeting is to be held November 4-6 at the Sheraton-Park and Shoreham Hotels, Washington, D. C.

Senator Bennett is to be the principal speaker at the opening session. Secretary Weeks will present the outlook of what lies ahead for the nation on the second day of the Meeting.

Dr. Ernest Dale, Associate Professor of Economics and Business Administration at the Graduate School of Business Administration of Cornell University, will speak on "Modern Management Practices and Techniques."

The Roof Coating Manufacturers' Forum will take place on November 4. Robert I. Wray is to speak on "Aluminum Asphalt Roof Coatings," and Dr. Arthur Van Heuckeroth will discuss "Simulated Exposure Tests vs. Actual Exposures." A third speaker is to be scheduled.

The Advertising and Sales Promotion Managers' Forum on November 4 will feature a talk by W. D. Kinsell, Jr., on how paint companies arrive at color changes in various lines. George V. Wise will discuss unusual methods in advertising and selling, and Horace Felton, Jr., will speak on sales incentive programs. Recruiting of salesmen and sales trainees will also be discussed.

Robert A. Whitney, advisory consultant to the National Sales Executives, will address the afternoon session of November 5. He will speak on "Our Nation Looks to the Sales Executive."

The Trade Sales Forum on November 5 is to have as its theme "What is Expected of Our Products." Panel members will include Waldron Faulkner, architect, Robert P. Furman, builder, and Robert C. Peacock, institutional maintenance.

The Putty, Glazing and Caulking Compound Forum will be held on November 5. R. A. Nolan of General Services Administration will speak on Federal procurement and specification of putty, glazing and caulking compounds.

The Industrial Product Finishes Luncheon and Management Panel will be held on November 5. John A. Kellogg of the Institute of Motivational Research will speak on "How to Make People Buy," and Dr. Arthur Secord of Brooklyn College will speak on "How to Develop Sales Leadership."

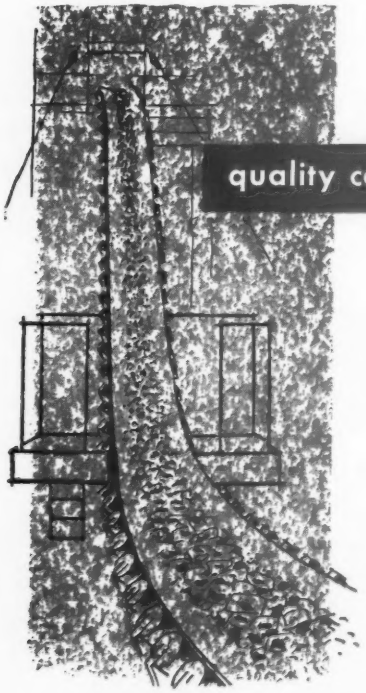
Leo Cherne of the Research Institute of America is to address the Meeting on November 6. At the same session Margaret Doughty will make a presentation on selling the teenager for future paint markets.

•

The Manufacturing Chemists' Assoc. sponsored a Chemical Industry Safety Workshop in Philadelphia on September 20, which was well attended.

Members of the MCA General Safety Committee discussed mutual and individual problems with plant safety officials of the Greater Delaware Area. The Workshop was part of a continuing program formulated by the Committee.

George L. Gorbell of Monsanto Chemical Co., St. Louis, is chairman of the General Safety Committee.



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New Books

The Science of Engineering Materials

Edited by J. E. Goldman. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Price $12.00.

Based on proceedings of the Carnegie Conference on the Impact of Solid State Science on Engineering Education held at Carnegie Institute of Technology in 1954. Reflects the accelerating trend toward applying tools of basic science to the solution of engineering problems.

Seventeen contributors set down the principles of solid state physics as they apply to the explanation of properties of materials. Metals, alloys, semiconductors, cements, plastics and glasses enter into the discussion of the behavior of materials.

Quality Control and Statistical Methods

By Edward M. Schrock, Chief Quality Control Engineer, Plumbing and Heating Division, American Radiator & Standard Sanitary Corp., New York, N. Y. Published by Reinhold Publishing Corp., 430 Park Avenue, New York 22, N. Y. Price $6.75.

The second, revised edition of a volume on applying statistical methods to the problems of industrial quality control. The second edition covers the development of the quality control field, and the statistical and administrative problems connected with the organization of a quality control program.

New material has been included on rapid approximate tests of significance and analysis of variance. Sample problems have been added for demonstration and practice.

The volume covers: the nature and economic objectives of quality, the means of presenting information pertaining to quality, the applications of various types of control charts, various modifications of control limits, probability distribution and significance of differences, the nature of acceptance sampling, and correlation.

•

Eastman to Train Execs

An "exchange-of-duties" training program designed to meet the need for men with broader knowledge and experience in all phases of of the firm's activities has been announced by Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co.

The new program involves the exchange of assignments between executives in various phases of the division's operations.

The first exchange in the program finds J. H. Sanders, Cleveland district manager, assuming the duties of product manager for all industrial chemicals manufactured by the division in Longview, Tex.

R. W. Miller, whose job Sanders takes over, moves to Cleveland to take charge of the division's direct sales in that area.

It is expected that the exchange-of-duties program will require assignments of from one to two years to provide each participant with a thorough background of experience.

•

Oronite Opens New Office

Oronite Chemical Co. has announced the opening of its southeastern district sales office in the Delaware Trust Building, Wilmington, Del.

B. W. Colaianni, recently promoted to district sales manager, heads the new office.

G. W. Corddry Receives Award

Graham W. Corddry, manager of National Lead Co.'s titanium division, and vice president in charge of sales for Titanium Pigment Corp., has been awarded a gold watch in recognition of 25 years of service with the company, it has been announced.

Mr. Corddry has been eastern sales manager, general sales manager and assistant manager of the titanium division during the course of his career.

•

Machine Rights Acquired

The Cleveland Automatic Machine Co. has announced the acquisition of certain assets of Hy-R-Speed, Inc., of Los Angeles, Calif.

Among the assets acquired are all rights for the manufacture and sale of Hy-R-Speed Mills, which are designed for various types of grinding. The mills will complement machinery products for the process industries manufactured by the J. H. Day Co. division of Cleveland Automatic Machine Co.

•

Sonneborn Honors Brand

Edgar E. Brand was honored last month upon completion of 35 years of service with L. Sonneborn Sons, Inc. Mr. Brand is a vice president of the firm.

The loyalty and ability of Mr. Brand were praised in an informal ceremony in the office of Rudolf G. Sonneborn, president of the firm.

Mr. Brand rose from office boy in the export department to his present position. He is credited with opening the western territory for the firm, and is now in charge of western and national sales of many Sonneborn products.



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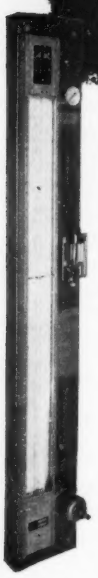
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DEHYDAG

CALENDAR OF EVENTS



Oct. 30-Nov. 2—Annual Convention, Federation of Paint and Varnish Production Clubs, and Paint Industries' Show, Bellevue-Stratford Hotel, Philadelphia, Pa.

Nov. 4-6—70th Anniversary Meeting of National Paint, Varnish and Lacquer Assoc., Sheraton-Park and Shoreham Hotels, Washinton, D. C.

Dec. 2-6—Chemical Industries Exposition, Coliseum, New York, N. Y.

Production Club Meetings

Baltimore, 2nd Friday, Park Plaza Hotel.

Chicago, 1st Monday, Furniture Mart.

C.D.I.C., 2nd Monday.
Cincinnati — Oct., Dec., Mar., May, Hotel Alms.
Dayton — Nov., Feb., April, Suttmilers.
Columbus — Jan., June, Sept., Fort Hayes Hotel.

Cleveland, 3rd Friday, Harvey Restaurant.

Dallas, 1st Thursday after 2nd Monday, Melrose Hotel.

Detroit, 4th Tuesday, Rackham Building.

Golden Gate, 3rd Monday, Sabella's Restaurant, San Francisco.

Houston, Monday prior 2nd Tuesday, Ship Ahoy Restaurant.

Kansas City, 2nd Thursday, Pickwick Hotel.

Los Angeles, 2nd Wednesday, Scully's Cafe.

Louisville, 3rd Wednesday, Seelbach Hotel.

Montreal, 1st Wednesday, Queen's Hotel.

New England, 3rd Thursday, University Club, Boston.

New York, 1st Thursday, Brass Rail, 100 Park Ave.

Northwestern, 1st Friday, St. Paul Town and Country Club.

Pacific Northwest, 3rd Thursday, Washington Athletic Club, Seattle, Wash.

Philadelphia, 3rd Wednesday, Philadelphia Rifle Club.

Pittsburgh, 1st Monday, Gateway Plaza, Bldg. 2.

Rocky Mountain, 2nd Wednesday, Republican Club, Denver, Colo.

St. Louis, 3rd Tuesday, Kings-Way Hotel.

Southern, Annual Meetings Only.

Toronto, 3rd Monday, Oak Room, Union Station.

Western New York, 1st Monday, 40-8 Club, Buffalo.

Printing Ink Firm Acquired

American-Marietta Co. has announced the signing of an agreement providing for the purchase of assets and business of Sinclair & Valentine Co., manufacturer of printing inks, pigments and chemicals with headquarters in New York.

Directors of both firms have unanimously approved terms of the transaction involving 209,969 American-Marietta Co. common shares. Each Sinclair & Valentine common share was to be exchanged for 1.5 shares of American-Marietta.

American-Marietta will hold a substantial controlling interest in Sinclair & Valentine Co. of Canada, Ltd., which has eight Canadian plants. Foreign operations will also be conducted in Mexico, Cuba and Colombia.

M. J. Leckey, president of Sinclair & Valentine Co., will continue in that capacity. Walter L. Kitchen remains as head of the Canadian firm.

In another expansion move, the firm has joined with Booty Resineers, Inc., of Newark, Ohio, through an exchange of shares.

The Booty Resineers division gives American-Marietta additional markets through the manufacture of synthetic resin adhesives, textile finishes and plastic coating compounds.



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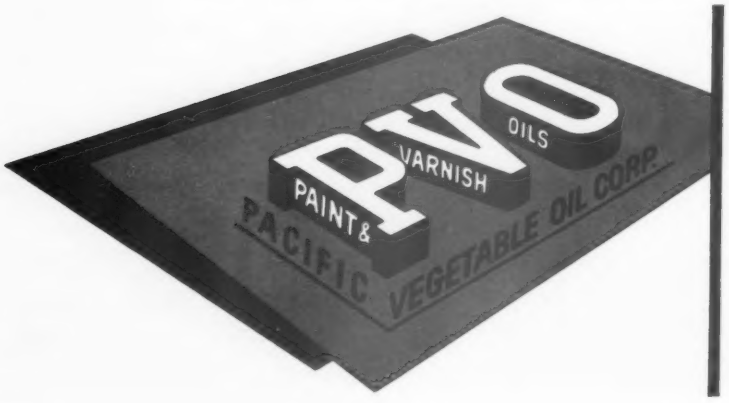
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The above quotation is from a recently issued report by Daniel-Litter Laboratories, New York City, consultants for the protective coatings, ink and allied industries.

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NEWS

Water-Thinned Vehicle Used for Gloss Finishes

Archer-Daniels-Midland Co. has announced the development of gloss and semi-gloss interior paints and industrial finishes using a water-thinned vehicle.

The announcement was made at a symposium on water-based paints held at the firm's research center in Minneapolis. Representatives of approximately 50 paint manufacturing firms attended the meeting.

Arolon 110, an oil and water emulsion previously recommended for use in flat interior paints, was used to accomplish the new development. ADM researchers pointed out that the emulsion permits a high pigment content in gloss and semi-gloss finishes, which gives an excellent covering quality while retaining high adhesive and water resistant properties.

Although ADM does not yet have sufficient data to recommend Arolon 110 for exterior paints, the firm revealed that tests are being conducted on buildings painted with Arolon-based paints in California, Florida and Minnesota.

Arolon 304, a water-thinned solution, has proven successful for industrial primers and enamels over metal, the company claimed. In addition, Arolon-based industrial enamels were said to have good adhesion and toughness. The primer is characterized by adhesion, hold out, high salt spray resistance and good application properties, company researchers said.

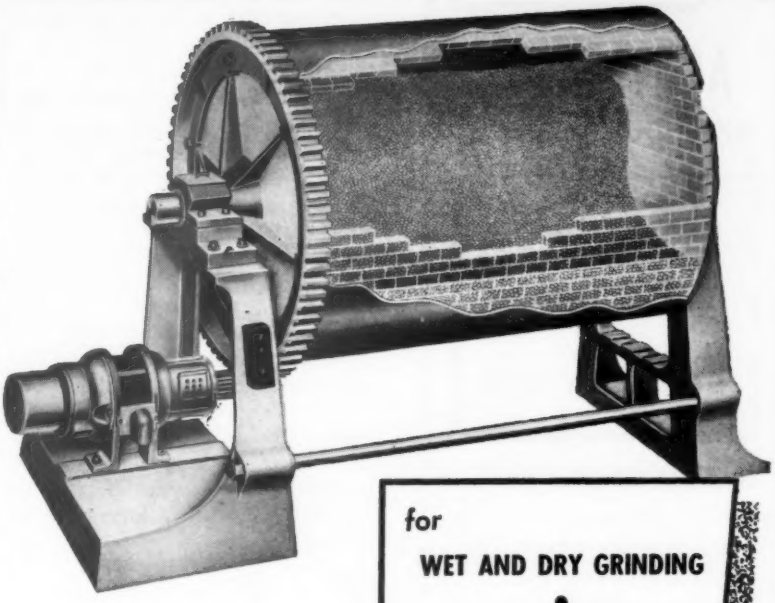
Speakers at the symposium were Robert Boller, project leader of the water-thinned vehicle research group, and Robert Price and Harold Langland, paint chemists.

•

Named Section Chairman

Dr. Charles C. Yeager, technical director of the cunilate division of Scientific Oil Compounding Co., Inc., has been elected chairman of the Microbiological Deterioration Section of the Gordon Research Conferences for 1959.

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VARNISH

(*From page 75*)

Armstrong cleans the unit about every four days, kettle being cleaned at the same time.

Bendix Ultra-Viscoson

Another instrument which has shown some degree of success in continuous and instantaneous viscosity measurement is the Ultra-Viscoson, produced by Bendix Aviation. This apparatus together with a Honeywell ElectroniK instrument is said to provide a simple all-electronic viscosity measuring and recording system. The recording instrument can be equipped with alarm contacts for high and low limit signalling when the viscosity exceeds predetermined limits. Also, the instrument can be supplied with either electric or pneumatic control components for control purposes.

According to the producer, the Ultra-Viscoson was developed to overcome the stringent obstacles associated with continuous and instantaneous viscosity determinations in processing equipment. These include high operating temperatures, pressures ranging from low vacuum to several thousand pounds per square inch, flammability and explosive nature of the material.

This instrument measures the change of energy imposed by super-sonic electrical waves as they vibrate in a small probe immersed in the resin or polymer. The energy change is recorded electrically directly in poises.

A basic Ultra-Viscoson ElectroniK measuring system comprise (1) a probe as shown in Figure 9,



Figure 9. Cut-away view of typical kettle-type Ultra-Viscoson probe.

(2) a computer, (Figure 10) and ElectroniK circular chart or strip chart recorder. Figure 11 shows measuring arrangement of the system.

In processing work, the sensing element or probe is permanently



Figure 10. Ultra-Viscoson electronic computer.

mounted by means of threaded connections directly in the vessel or pipe line. In laboratory use, the probe can be dipped into practically any container. Electronic computer and recording instrument are installed at any convenient location, and the probe is connected to the computer by means of a cable that may be run in conduit. Recommended maximum cable length is 1,000 feet unless special low capacity cable is employed.

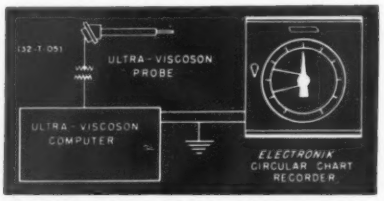


Fig. 11. Basic Ultra-Viscoson-ElectroniK measuring, indicating and recording system. A strip chart recorder can also be employed.

The probe is designed for continuous duty for temperatures between −180°F and +650°F.

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Diamonite Names Agent

Ben Kanowsky, Inc., 5513 Maple Ave., P.O. Box 7313, Dallas, Tex., has been named representative for Diamonite products in the Oklahoma-Texas area, it has been announced.

NEWS

Says Quality Paints Economical Despite Cost

The Public Housing Administration has found that it is cheaper to use paint costing $8.00 a gallon than it is to use paint selling for only $1.85 a gallon.

Rutcher Skagerberg, assistant director of the Administration's Operations and Engineering Branch, said that, "The time involved in applying the paint and the amount of material used made it more economical to use the expensive material."

Mr. Skagerberg spoke at a symposium on government procurement. He pointed out that the housing agency annually paints 420,000 units at a cost of approximately $10 million. He said the cost of paint represents only 15 to 20 per cent of the total cost, with labor being the greatest expense.

"To reduce the labor involved," he said, "simply means making the job we do more durable so that we do not have to go back so often. I believe the better quality paint means that it is going to last longer. That is where the payoff is going to be."

DeVilbiss Gains Subsidiary

The DeVilbiss Co. has announced an agreement to purchase the Newcomb-Detroit Co., a firm engaged in the design, manufacture and installation of custom-built industrial finishing equipment.

According to Howard P. DeVilbiss, president of The DeVilbiss Co., the Michigan firm will remain a corporate entity, and will be operated as a subsidiary. As a result of the move, DeVilbiss acquires additional manufacturing facilities in Detroit and Grand Rapids, Mich.

The transaction was to be accomplished by an exchange of stock, details of which have not been disclosed.

G.E. Consolidates on Coast

West Coast headquarters of General Electric Co.'s chemical materials department have been moved from Los Angeles to the firm's plant at 1211 North Olive St., P.O. Box #630, Anaheim, Calif., it has been announced.

The chemical materials department handles sales of Glyptal alkyd resins for the paint industry.

J. L. Galt, general manager of the West Coast section of the department, has also announced that the organization has established a San Francisco sales office at 436 Peninsular Ave., San Mateo.

SUCO Opens New Office

Standard Ultramarine & Color Co. has announced the opening of a southern sales office in the New Orleans area.

The office will be headed by Philip B. Mishoe, who has been associated with the firm's sales staff for the past twelve years. He has been active in the southern area during the last eight years.

The new office is located at Room 210, 3625 Airline Highway, Metairie, La.

To Build Urea Facilities

Hercules Powder Co. has announced construction of facilities for the production of 10,000 tons of urea per year at the Hercules, Calif., plant.

Anhydrous ammonia and carbon dioxide, are both currently produced at the plant.





New Filter

by CUNO

DOUBLES FINISH PROTECTION FOR THOSE SUPER-CRITICAL FINISHING JOBS

Guaranteed to remove 98-100% of all particles larger than 5 microns on the first pass of fluid, this new *WHITE* Micro-Klean Cartridge is Cuno's latest contribution to progress in the Paint Industry.

Preliminary on-the-job tests at the Pittsburgh Plate Glass Company have proved conclusively that this new White Cartridge assures more complete removal of all skins, fisheyes, and oversized pigments or particles in the production of fine enamels of #8 grind and larger. The firm inert-resin-bonded white cellulose fibers of this exclusive cartridge cannot loosen to contaminate fluid . . . cannot rupture or channel. In addition, the new White Cartridge retains the graded-density feature of the standard Cuno Micro-Klean Filters; has the same long-lasting qualities that reduce replacements and insure lower per-gallon filtration costs . . . and it can go to work in your plant without delay, because it fits in the same housings you've been using for the 10 micron filters.

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THE CUNO ENGINEERING CORPORATION
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PROCESS CONTROL

(*From page 52*)

known methods to record and control viscosity. One uses the Brookfield Viscometran viscometer, a rotational device sensitive to changes in liquid viscosity, to produce a capacity measurement, sensed by a Foxboro Dynalog recorder. Fig. 26 shows a schematic of the measuring unit and Fig. 27 shows a typical installation. Ranges are

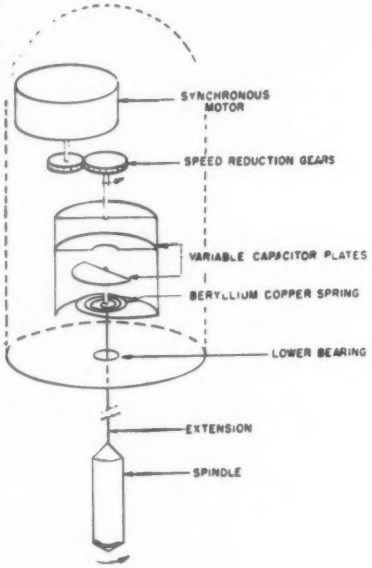


Figure 26.

available from 0-10 to 0-50,000 centipoises. The unit mounts on a 4-inch 125 pound pipe flange, under vacuum or pressure, directly on kettles or in a flow line.

Another system uses the Bendix Ultra-Viscoson viscometer, a device operating on a unique ultrasonic principle. (Fig. 28) A small steel probe is inserted into the liquid and oscillated electrically in pulses. The time taken to damp out the pulse is determined by the amplifier and an EMF signal sent to the Foxboro Dynalog recorder. The range may be 0-5 to 0-50,000 cp x gm/cc. This means that the measurement is sensitive both to viscosity and to density. The probe is readily mounted in vessels or lines and used under wide ranges of temperature or pressure.

The foregoing discussion is intended to awaken interest in the many possibilities that exist for the use of process instrumentation in the paint industry. Manufacturers of basic materials operating complex, continuous processes have long recognized the importance of automatic control to efficient operation and high product quality. These objectives are common to any industrial operation and the means to accomplish them are available through the proper selection of instrumentation.

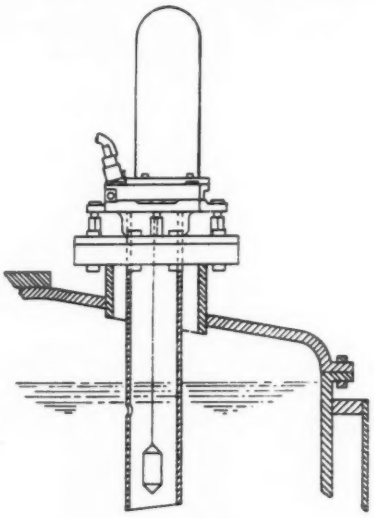


Figure 27.

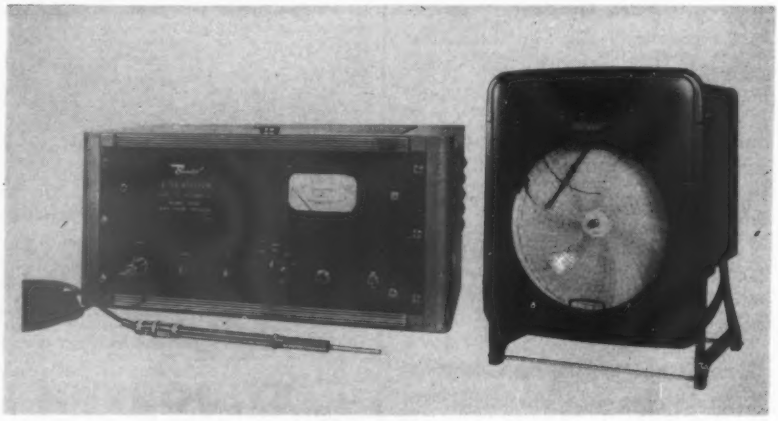


Figure 28.

AUTOMATIC HANDLING

(*From page 59*)

rate or storing the under or over feed caused by any one stream until corrective action can be taken.

A master drive or computer system, that is completely separate from the metering function, controls master blend rate. This is set through an infinitely variable speed changer. At each of the metering stations, a right-angle take-off delivers this speed to individual speed changers which are set for percentage or ratio. These drive individually into one side of mechanical differential units like Figure 17.

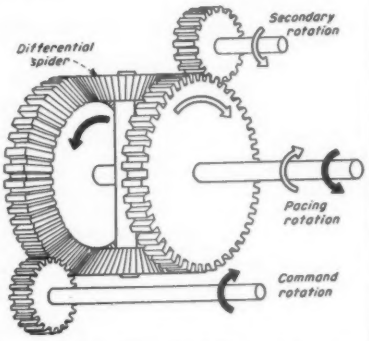


Figure 17. Geared differential proportioning controller.

Metering flow rates are delivered to the other side of this differential. Any difference in speed between the two inputs will re-position the spider gear which, through suitable linkage, will unbalance the air controller and cause a repositioning of the throttling valve in the particular line in which this condition occurs. The valve will move to correct this upset condition.

A unique feature of this scheme is the built-in requirement that the spider must return to the setpoint position for the system to be in balance. In doing so, it makes up or eliminates the shortage or overage which caused the upset condition. Any failure of the control mechanism to maintain conditions within set limits will automatically stop the blender operation and actuate suitable alarm devices.

While the controlled system metering devices have been shown as positive displacement meters, any of the devices previously described can be incorporated in this scheme.

In describing how the various items of equipment can be incorporated we have necessarily been very brief. Numerous arrangements are possible and each one must be analyzed in light of the particular process requirements. We recommend that any approach to inline blending be carefully reviewed by someone experienced in this type of engineering so that maximum benefits can be obtained. There is no doubt that economies can be accomplished. It is our hope that this review has enabled the reader to become better acquainted with what is being done and what can be done as it applies to his particular requirements.

Engineering Firm Organized

An engineering firm has been organized to offer combined services in all branches of engineering and chemistry, including plant design, testing, high polymer and coatings technology, economic and technical surveys, contract research, chemical processes, mechanical controls design, instrumentation and formulation.

The new firm is called Consulting Associates, and is located at 1096 East 64th St., Cleveland 3, Ohio. E. I. Arsan, technical director, said the firm was organized to provide technical talent to those who cannot employ full time scientists of specialized skills.

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RHEOLOGY

(*From page 71*)

The principal method of signal transmission is by variable capacitance. One side of a variable condenser is attached to the inside of the cage while the other side is connected to the upper spindle arm. The angular relationship between the cage and the spindle is thus made proportional to a capacitance.

Another type of transmission is by variable resistance. A potentiometer is mounted in the cage while its free member is connected to the upper spindle arm. In this case the angular relationship between the cage and the spindle is made proportional to a resistance. The Viscometran has a range of 0 to 500 poises.

Drage Viscostat

Two adjustable contacts are built into the Viscostat on either side of the pointer and are connected to a regulating device which may be situated either at the process to be controlled or at a remote control station. This control device has three pilot lights; one to indicate that the system is "on", one to indicate that the viscosity of the test material is at the upper limit and the other to indicate that it is at the lower limit. The actual viscometer is encased by a housing, through which the measuring axle projects. A recording drum is incorporated in the pointer axle. The paper-or measuring-drum is replaced by three displaceable contacts as well as by a return contact. These contacts are connected to three associated relays in a switch box. If now the impulse contact closes, causing the magnet in the Drage Viscostat to pick up, then the contacts are pressed against the recording drum. Depending on which of the contacts is actuated by a helix, the following circuits can result; if the viscosity is too high then a contact closes, thus switching in the relay, which then causes a switch to close. The switch can be used, for example, to actuate a valve regulating the supply of thinning medium to the substance causing the viscosity to drop. As soon as the desired viscosity has been reached, another contact is closed and the next impulse is imparted. This places a relay in circuit and thus causes another relay to cut out, which in turn opens a switch thus closing the valve. Should, for one reason or another, the viscosity of the medium under control decrease below the desired value, as adjusted on one contact, then another contact and a relay enter into action and the switch is closed; this in turn either actuates a warning signal or initiates a cooling or other process so that the viscosity reverts once more to the desired value.

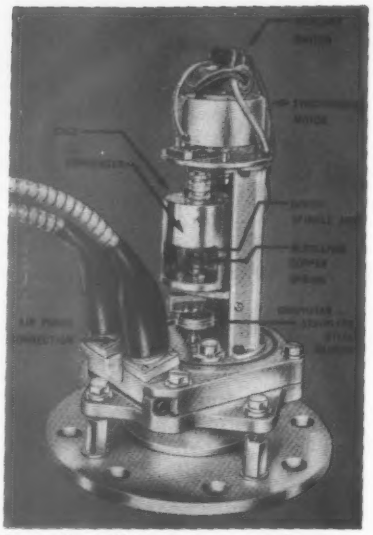


Fig. 33. Viscometran with cover removed.



Fig. 34. Drage Viscostat

Other Types

Holzbock (11) describes the De Zurik Regulator as consisting mainly of an agitator wheel suspended in a suitable flow box and driven by an electric motor. With a slight change in the consistency of the stock, there is corresponding change in the torque required to rotate the agitator. This torque is transmitted to a flapper and nozzle arrangement which converts it into an air pressure signal. The speed of the agitator wheel, i.e., the rate of shear, is constant.

A continuous indicating and recording viscometer developed by Shell (18) and manufactured and marketed by Hallikainen makes use of a pressure drop across a capillary tube. The material under test is caused to flow at constant rate of approximately 50 ml. per min. by means of a Zenith gear pump.

Ultrasonic Engineering manufactures a vibrating (magnetostriction) reed viscometer. The Ultrasonic probe uses two coils to drive the vibrator and to receive the return signal from which drag or viscosity is computed. Energy is fed into the probe continuously and signals are received continuously, to and from the vibrating reed (18).

CLASSIFIED ADVERTISEMENTS

Rates: $.20 per word, except those seeking employment, for which rate is $.10 per word. Minimum: ten words. Address all replies to Box Number, c/o Paint and Varnish Production, 855 Avenue of the Americas, New York 1, New York.

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TECHNICAL Bulletins

BUTANOL

Butanol is discussed in a folder released by Union Carbide Chemicals Co., Division of Union Carbide Corp., Dept. PVP, 30 E. 42nd St., New York 17, N. Y.

Designated F-7909, the booklet presents data on physical and physiological properties, specifications, shipping information, solubilities, constant-boiling mixtures and applications.

Easy to read charts give physical properties of interest to users of butanol.

SIDE-ENTERING AGITATORS

An eight-page brochure on side-entering agitators covers mechanical design details and includes a table of standard sizes and dimensions and an outline of the supplementary information that is supplied with each installation.

The brochure is available from Industrial Process Engineers, Dept. PVP, 8 Lister Ave., Newark 5, N. J.

URETHANE

A six-page technical bulletin on urethane is being issued by FMC Organic Chemicals Division, Food Machinery and Chemical Corp., Dept. PVP, 161 E. 42nd St., New York 17, N. Y.

The bulletin, called Technical Bulletin No. 5, covers physical properties, specifications and analysis, commercial information, chemical properties and uses for urethane.

A bibliography listing additional sources of information is also included.

INDUSTRIAL TRUCKS

The right truck and attachment for practically every mechanical handling application is covered in a 12-page condensed guide of industrial trucks and attachments prepared by Hyster Co., Dept. PVP, 2902 N. E. Clackamas St., Portland 8, Ore.

The booklet covers the firm's complete line of basic truck models. Working specifications for each truck shown in the catalog include load capacity, stacking aisle and turning radius, tire size, grade climbing ability, engine horsepower, lifting and travel speed, truck weight and optional equipment.

A wide range of such features as special forks, swing-shift aprons, booms and rams are also covered.

CONTROLLED VOLUME PUMPS

Bulletin No. 557, "H20 Controlled Volume Pumps," has been released by the Milton Roy Co., Dept. PVP, 1300 E. Mermaid Lane, Philadelphia 18, Pa.

The four-page bulletin contains complete specifications, design features, dimensions and ordering data. The bulletin also includes photos and diagrams of the H20 Packaged Systems and Barrel Pumps.

MATERIALS HANDLING

An eight-page circular describing the "One Man Crew" materials handling system is available from Lewis-Shepard Products, Inc., Dept. PVP, 125 Walnut St., Watertown 72, Mass.

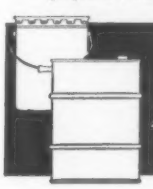
Included in the fully-illustrated presentation are descriptions of the system, how it may be utilized and its advantages. One section outlines the type of equipment required for the "One Man Crew."



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EXTINGUISHER TESTING

"Methods of Testing Small Fire Extinguishers" is available, designated National Bureau of Standards Building Materials and Structures Report 150.

The report covers a study to develop suitable test methods for determining the extent of differences in the performance of various types of small hand-portable fire extinguishers.

The study was performed by evaluating the effectiveness of the extinguishers using five extinguishing agents on ten types of fires. The work is sufficiently broad to be applicable to many types of small liquid fires.

The nine-page report contains seven illustrations and seven tables. It is available for 15 cents from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

PREPARATIVE CENTRIFUGE

Details of the Beckman Spinco Model K, a 51,000-times-gravity laboratory centrifuge, are contained in a publication designated Form SBK-1, released by Spinco Division, Beckman Instruments, Inc., Dept. PVP, 1237 California Ave., Palo Alto, Calif.

Included in the literature are details on insulated, core-ventilated rotors which make it possible to operate a centrifuge up to speeds of 25,000 rpm in air without overheating and the problems of thermal convection in the rotor.

Specification section presents a list of rotor speeds available, technical details and specifications of the two rotors featured.

TUNG RESEARCH

A list of publications reporting research by the U. S. Dept. of Agriculture on the processing and utilization of tung products has been issued by the Southern Utilization Research and Development Division, 1100 Robt. E. Lee Blvd., New Orleans 19, La.

The booklet is useful as a review of trends in tung utilization research over the past 20 years, and from it may be selected technical papers giving information on subjects of particular interest.

A total of 111 publications and five patents are listed, with abstracts, covering the period from 1935 to the present. The bibliography is titled "Tung-Twenty Years of Research."

PROCESSING MACHINERY

The J. H. Day Co., Dept. PVP, 4932 Beech St., Cincinnati 12, Ohio, has released a four-page bulletin illustrating and describing Day mixers, blenders, sifters and roll mills.

Titled General Bulletin No. 557, the publication presents design features and specification tables on the various pieces of equipment.

DISPERSION COATINGS

Advantages of halofluoro-carbon dispersion coatings for industrial corrosion control and contamination prevention are described in a four-page booklet on the "Kel-F" brand dispersion coating system.

Chemical resistance, thermal stability, toughness and flexibility, abrasion resistance, dielectric strength and anti-sticking surfaces are included in the combination of properties offered by the system, according to the booklet.

Among applications for the system illustrated in the publication are ventilation fans that exhaust corrosive plant fumes, tank trailers and agitator paddles used in pharmaceutical packaging.

Copies of the booklet are available from Minnesota Mining and Manufacturing Co., Dept. PVP, 900 Bush St., St. Paul, Minn.

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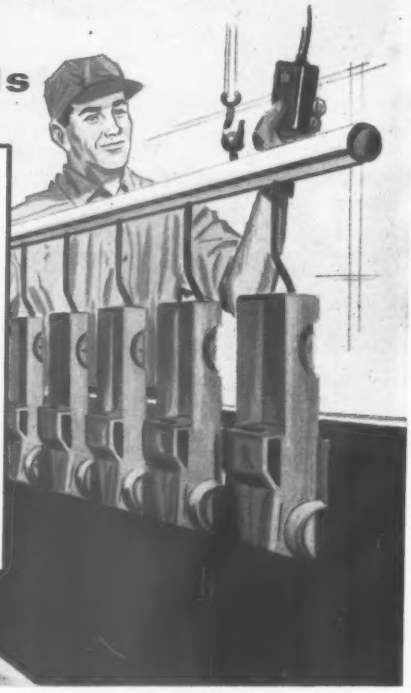
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9.30	Urea Formaldehyde Solution 50% solids by wt.	1.13
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MATERIALS PRESERVATION

Papers presented at a joint military-civilian symposium on preservation of materials and equipment are contained in a 524-page volume released for industry use through the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D.C.

The conference was held in October, 1956, under Navy sponsorship, and was attended by preservation authorities from industry, research organizations and the armed services. Some 40 papers were submitted covering a wide range of problems. Preservation materials such as Teflon, organic coatings and liquid corrosion inhibitors were also dealt with.

The report is titled PB131007 *Symposium on Preservation for Mobilization Requirements*, U. S. Naval Civil Engineering Research and Evaluation Laboratory, Oct. 1956. It is priced at $8.

ASTM PROCEEDINGS

The 1956 edition of the ASTM Proceedings has recently been published. The 1510-page volume includes technical reports, papers and other accomplishments of ASTM for 1956.

A summary of the 59th Annual Meeting held June, 1956, noting the title and author of each paper presented is also included. The Proceedings contains discussions that have not previously been published.

Copies are available at $12 each from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

STEEL PRODUCTION

"The Making, Shaping and Treating of Steel," a one-volume reference work on the iron and steel industry, has been published in its seventh edition by U. S. Steel Corp.

Completely revised since its sixth edition was issued in 1951, the new volume offers a comprehensive summary of present-day theory and practice covering all phases of iron and steel production from raw materials to finished products.

Recent developments in steel making and processing that are reviewed include the methods and equipment used in extrusion and advances in pneumatic steel making processes. Steel scrap is the subject of a new section, and an expanded history of ferrous metallurgy is presented.

Copies may be obtained for $7.50 from United States Steel, Office Service-Stores, 525 William Penn Place, Pittsburgh 30, Pa.

AUTOMATION

A folder titled, "Automation, Its Meaning and Implications," has been made available by Island Equipment Corp., Dept. PVP, 27-01 Bridge Plaza North, Long Island City 1, N. Y.

The booklet covers a speech before the Miami Chapter of the American Materials Handling Assoc. by James C. Vadakin, Professor of Economics at the University of Miami.

HOMOGENIZER-MIXER

A reprint of a technical article which explains the advantages of an Eppenbach Agi-Mixer over conventional mixing equipment is being offered by Gifford-Wood Co., Dept. PVP, 420 Lexington Ave., New York 17, N. Y.

The article describes the way double-motion rotating blades work materials down toward the bottom of a kettle, where they are subjected by a Homo-Mixer to refinement by hydraulic shear.

Additional features which eliminate vortex and insure better heat transfer are discussed, as well as operation of the homogenizing element. Auxiliary equipment is listed, and photographs of the entire unit appear.



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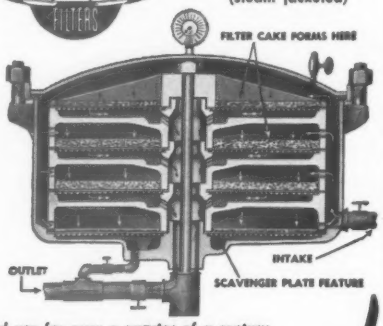


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AIR REDUCTION DIRECTORY

A complete listing of the divisions and subsidiaries of Air Reduction Co., Inc., appears in a directory available from Air Reduction Co., Inc., Dept. PVP. 150 E. 42nd St., New York 17, N. Y.

The publication includes both domestic and international listings. Included are locations of general offices, sales offices, plants and warehouses and the products marketed by each company.

Also included is an alphabetical list of the products of the entire organization with the division that markets each.

WEIGHT MEASUREMENT

A 20-page bulletin on the weighing of bulk material titled, "Weight . . .Its Measurement and Control," has been published.

The bulletin compares batch-in, batch out and continuous weighing processes, and explains how a completely automatic weighing system may be assembled by building block techniques using unitized weighing components.

Both pneumatic and electrical weight transmitters are discussed. A special section explains the Uni-Force flexural scale system which gives correct weight readings, even when asymmetrically loaded, by resolving any load condition into a single, accurate component of force.

Also included is a description of a line of conveyor scales and weigher-feeders which can be added to existing systems.

The bulletin, No. 12, is available from Weighing and Control Components, Inc., Dept. PVP, 536 Lincoln Ave., Hatboro, Pa.

CENTRIFUGES

Small and medium angle centrifuges are the subject of an eight-page catalog released by Ivan Sorvall, Inc., Dept. PVP, Norwalk, Conn.

Each of five models is described in detail, and a reference chart showing various combinations of tubes that may be accommodated is included. The catalog also discusses the Angle Principle and the Servall-Blum Self-Centering Direct Drive which minimizes problems of balance and vibration.

Other Servall laboratory instruments are described and illustrated in the catalog.

DRUM CLEANING

Rapid, efficient removal of dirt, rust, paint and other foreign materials from drum exteriors, interiors and lids by Rotoblasting is described in a four-page specification bulletin released by the Pangborn Corp., Dept. PVP, Hagerstown, Md.

Bulletin No. 220 explains how the firm's ES-382 automatic drum cleaning machine cleans covers and drums inside and out with a single Rotoblast wheel. Automatic loading techniques for 30 and 55-gallon drums, production cost studies, operator safeguards, engineering specifications and diagrams are also presented.

Specifications include plan and front view plus information on space required, overall height, shipping weight, abrasive requirements and other engineering data.

PENTAERYTHRITOL

A 56-page presentation of technical data on pentaerythritol titled, "Pentek, Its Uses In Resins for the Surface Coating Industry," has been published by Heyden Newport Chemical Corp., Dept. PVP, 342 Madison Ave., New York 17, N. Y.

Detailed information on the formulation and laboratory preparation of Pentek-derived resins for the coating industry is contained in the booklet. Material is based on the firm's research.

One section of the publication relates to the new high polymer technique which improves the properties of alkyd resins. Also detailed is technical material on the use of pentaerythritol in tall oil modified alkyds and in glycol modified medium and short oil alkyds.

Also reported are formulations of isophthalic long oil alkyds which have distinct advantages for exterior house paints.

RESEARCH REPORTS

A free price list of Atomic Energy Commission unclassified research reports for sale by the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C., is available upon request.

The cumulative listing of more than 4,500 AEC reports in the OTS collection includes new documents acquired since December 31, 1956. The list has been designated AEC Research Reports Price List No. 28.

FLAME TESTS

A report describing tests of four heat resisting paints for use on rocket launchers has been released by the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C.

The purpose of the investigation was to determine the resistance of the paints to the high temperature of a blast flame of short duration as obtained in firing rockets.

Results of the tests indicate that zinc pigmented dibutyltitanate paint will withstand the heat of a blast flame somewhat better than the best of the aluminum pigmented silicone paints which have been previously tested.

The report is titled, PB121736, *Heat Resistant Paints for Rocket Launchers*, T. Rice, Rock Island Arsenal Laboratory, U. S. Army, Sept. 1956. The 12-page report is priced at 50 cents.

PROCESSING EQUIPMENT

A six-page, two-color brochure describes grinding and mixing equipment of Paul O. Abbé, Inc., Dept. PVP, 141 Center Ave., Little Falls, N. J.

Included in the brochure are information and illustrations of ball and pebble mills, mass and paste mixers, drum rollers and tumblers, jar mills and jar rolling mills, rotacone blenders and dryers, ribbon mixers and lump breakers.

TEST FACILITIES

A brochure describing environmental test facilities available has been released by Associated Testing Laboratories, Inc., Dept. PVP, 414 Clinton Road, Caldwell, N. J.

The brochure is illustrated to show equipment used in performing such tests as vibration, high and low temperature, humidity, altitude, high and low temperature vibration, explosion proof, salt spray, acceleration and others.

The brochure further describes testing to military, A.S.T.M. and industrial specifications.

AEROSOLS

An illustrated, colorful booklet on aerosols describes their history, growth and market, and industyr services and research on aerosols done by the Continental Can Co.

The various types of aerosol cans are pictured, and specifications are given, as well as a listing of products suitable for aerosol packaging. Also given are aerosol contract fillers. A listing of district sales offices is also included.

The booklet is available from The Continental Can Co., Dept. PVP, 100 East 42nd St., New York 17, N. Y.

TESTING INSTRUMENTS

A series of newsletters illustrating and describing a number of testing instruments is available from Gardner Laboratory, Inc., Dept. PVP, Bethesda 14, Md.

Titled Volume 4, Nos. 29-33 of the Gardner Laboratory Newsletter, the bulletins cover high-sensitivity self-standardizing collor-difference meter, Elcometer dry film thickness gage, vertical viscometer and kit, interchemical wet film thickness gage and Sherwin-Williams high-shear vis-cometer.

PICTURE VARNISH

"Factors Affecting the Appearance of Picture Varnish" is the title of a paper by Robert L. Feller of the Mellon Institute.

The paper is available from Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.

ROTO-CAM CONTROL

A circular describing recently-introduced Roto-Cam Control for electric "walkie" type materials handling trucks has been made available.

Designated Circular 34-H, the four-page presentation explains the features and operating details of Roto-Cam Control. The circular is fully illustrated with photos and drawings.

The circular is being issued by Lewis-Shepard Products, Inc., Dept. PVP, 125 Walnut St., Watertown 72, Mass.

HEXANETRIOL

A technical bulletin on 1,2,6-hexanetriol presents properties, shipping information, solubilities, performance data and applications.

The bulletin, designated F-40,-066, is available from Union Carbide Chemicals Co., Dept. PVP, 30 East 42nd St., New York 17, N. Y.

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